ABU DHABI NATIONAL OIL COMPANY

HEALTH SAFETY AND ENVIRONMENTAL MANAGEMENT
MANUAL OF CODES OF PRACTICE

VOLUME 4 : SAFETY

CODE OF PRACTICE ON DIVING OPERATIONS - RISK ASSESSMENT AND CONTROL

ADNOC-COPV4-09

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I. PURPOSE

This Code of Practice will provide all persons within ADNOC and Group Companies, directly or indirectly concerned with diving operations, with the necessary information to ensure that diving operations are conducted to the highest possible safety standards, taking into account all reasonably foreseeable circumstances.

This COP will apply to all diving operations conducted in connection with and in support of ADNOC Directorates, Group Companies and Affiliated Companies; from inshore to within the limits of the territorial waters of the Emirate of Abu Dhabi; including Petroleum Ports, docks, harbours, jetties, pipelines, inlets, lakes, ponds, culverts, tanks etc.; all water depths relevant to Abu Dhabi. Some aspects covered are unlikely to be encountered in Abu Dhabi because of the shallow water depths; however, they have been included to cover all possible present and future potential eventualities.

This document will also assist the following, among others:

- Personnel directly or indirectly involved in diving operations.
- Staff involved in the preparation of bid documents and contracts.
- Clients and Contractor Representatives.
- Vessel owners and marine crews involved with diving operations.
- Installation, Rig and/or Asset managers using divers.
- All personnel involved in Safety and Quality Assurance.

II. DEFINITIONS

ABLJ
Adjustable Buoyancy Life Jacket.

ACDE
Association of Commercial Diving Educators (US).

ADC
American Diving Contractors.

ANSI
American National Standards Institute.

AODC
Association of Offshore Diving Contractors (now IMCA).

BSAC
British Sub Aqua Club.

CMAS
Confederation Mondiale de activities Subaquatique (World Underwater Federation).

Company Medical Adviser
A nominated diving medical specialist appointed by a Diving Contractor to provide specialist advice.

Competent
Having adequate and sufficient training or experience (or a combination of both) to be capable of carrying out a task safely and efficiently.

Compression Chamber (DDC)
A pressure vessel for human occupancy which does not go under water. Also called recompression chamber, decompression chamber or deck chamber.

DCI
Decompression Illness.

DDC
Diving Decompression Chamber (see Compression Chamber).

Dive
A dive takes place when a person enters the water, a chamber, or any other environment in which he is subject to pressure greater than 100 millibars above atmospheric pressure and who in order to survive in such an environment breathes in air or other gas at a pressure greater than atmospheric pressure.

Diver
A person at work who dives (as defined above).

Diving Bell
A pressure vessel for human occupancy which is used to transport divers under pressure either to or from the underwater work site.

Diving Contractor
The company in charge of diving operations at a Group Company facility site/operation, normally the contractor company who employs the divers. If there is more than one contractor company employing divers, then there must be a written agreement as to which of these companies is the Diving Contractor i.e. the company in overall control of diving operations.

DMAC
Diving Medical Advisory Committee (part of IMCA).

Diving Medical Specialist
A doctor who is competent to manage the treatment of diving accidents, including where appropriate mixed gas and saturation diving accidents. Such a doctor will have undergone specialized training and have demonstrated experience in this field.

DSM
Diving Safety Memorandum.

DSV
A ship or other vessel (with sufficient space) whose primary role is the support of diving operations.

DPVOA
Dynamic Position Vessel Owners Association (part of IMCA).

Dynamic Positioning (DP)
A system whereby external reference systems are used to maintain a vessel in a predetermined position. Normally relies on computer control and built in redundancy levels.

High Occupational Health Risk
A risk that is determined to be HIGH in accordance with the risk rating of ADNOC '*COP Guideline on Occupational Health Risk Assessment (OHRA)*' (ADNOC-COPV3-08).

HSEMS
Health, Safety, Environmental Management System.

Hyperbaric Environment
Where the pressure is higher than atmospheric i.e. typically underwater.

IMCA
International Marine Contractors Association (previously named AODC).

IMO
International Maritime Organization.

Lift Bag
A bag which is filled with air or gas to provide up-lift to an underwater object. Often used by divers for lifting purposes.

Lock Off Time
The time at which a diving bell under pressure is disconnected from the compression chamber(s) on deck.

Lock On Time
The time at which a diving bell under pressure is reconnected to the compression chamber (s) on deck.

LST
Life Support Technician (in diving operations).

Media
Diving in support of underwater media work.

Medical Examiner of Divers
A doctor who is trained and competent to perform the annual assessment of fitness to dive for divers. They may not possess knowledge of the treatment of diving accidents.

MSC
Manpower Services Commission (UK).

MSV
Multi-support Vessel.

NAUI
National Association of Underwater Instructors.

NDT
Non-destructive Testing

NPD
Norwegian Petroleum Department

NRV
Non-Return Valve.

Occupational Health Hazard
This is an agent with potential to cause harm to health. These agents may be biological, chemical, physical, ergonomic or psychological in nature. Hazards are normally classified according to the severity of their adverse health effects.

PADI
Professional Association of Diving Instructors.

Permit To Work System
The system that allows central control and ongoing monitoring of higher risk activities on a site and in particular to ensure that activities are authorised, carried out by qualified personnel using appropriate safety precautions and that activities with potentially hazardous interactions do not take place at the same time.

Recreational Diving
Diving carried out by a person(s) for recreational purposes while not at work.

Risk Assessment
The process of determination of risk, usually in a quantitative or semi-quantitative manner. It is an evaluation of the likelihood of undesired events and the likelihood of harm or damage being caused together with the value judgements made concerning the significance of the results. Note the difference between Risk Assessment and Task Risk Assessment in this Guidance.

ROV/RCV
Remotely operated vehicle/Remotely Control Vehicle.

Scientific and Archaeological Diving
Diving carried out for the pursuance of scientific or archaeological activities.

SD
Surface Decompression.

SMS
Safety Management System.

Standby Diver
A diver other than the working diver(s) who is dressed and with equipment immediately available to provide assistance to the working diver(s) in an emergency.

SPC
Supreme Petroleum Council.

SWL
Safe Working Load.

TSA
Training Services Agency (UK).

UK-HSE
United Kingdom Health and Safety Executive.

UNESCO
United Nations Educational Scientific and Cultural Organisation.

USCG
United States Coastguard.

USN
United States Navy.

Wet Bell
A basket with a closed top section which is capable of containing a dry gaseous atmosphere to provide a refuge for the divers. It is not a pressure vessel. A main supply umbilical will come from the surface to the wet bell with the divers having their own separate umbilical, which terminate at the wet bell. A supply of spare gas will be carried on the wet bell. Also called an open bottom bell.

Further detail on definitions is provided in the document ADNOC Manual of Codes of Practice '*Guideline on HSE Definitions and Abbreviations*' [Ref. 51].

III. EXISTING LAWS

Existing legislation relevant to the subject of this Code of Practice includes:

1. Ministry of Labour and Social Affairs 'Federal Law No. 8 of the year 1980'.
2. Ministry of Labour and Social Affairs 'Ministerial Order No. (32) for the year 1982'.

[51] ADNOC Manual of Codes of Practice: '*Guideline on HSE Definitions & Abbreviations*', ADNOC-COPV1-05.

1. INTRODUCTION

Diving operation means an activity in which at least one person takes part or will take part as a diver and which can be safely supervised by one person. A person "dives" if he enters (a) water or any other liquid, or (b) a chamber in which he is subject to pressure greater than 100 millibars above atmospheric pressure; and, in order to survive in such an environment he breathes in air or other gas at a pressure greater than atmospheric pressure [Ref. 1].

Diving involves personnel exposure to potentially hazardous hyperbaric conditions. Risks from diving operations within ADNOC and Group Companies must be managed to acceptable levels by adhering to internationally-recognized industry standards for diving.

This Code of Practice establishes the HSE requirements for diving operations undertaken by Group Companies. It is applicable to all diving operations, whether carried out by Group Company personnel or contractors.

This Code of Practice is based on the current guidance and best practice, as defined by the International Marine Contractors Association (IMCA) and the UK Health and Safety Executive. It should be noted that IMCA is currently reviewing its guidance in several areas. Those responsible for organising/contracting diving services should therefore be aware of any changes in IMCA guidance that may impact on HSE, subsequent to the publication of this Code of Practice.

1.1 POLICY REQUIREMENTS

Diving operations are inherently hazardous with High Occupational Health Risk [Ref. 53]. As a consequence, it is ADNOC Policy that all ADNOC Group Companies with diving operations must:

- Seek to minimise the need for exposure of personnel to hyperbaric (i.e. raised pressure/underwater) environments.
- Have IMCA membership or any equivalent membership of regional organization.
- Contract all diving work as a service and invite bids only from those diving contractors with IMCA membership, and a good record of capability, health and safety in all aspects of diving. **ADNOC or Group Company employees should not dive as part of their work.** See Note *.

  * Note: IRSHAD, albeit an ADNOC Group Company, is considered a diving contractor in the context of this policy statement.

- Apply as a minimum contractual standard the UK/US/EU legislation for diving operations as the underwater service industry consensus of the "state-of-the-art" for diving operations.

[1] The Merchant Shipping (Diving Safety) Regulations 2002, S.I. No. 1587, HMSO, London, 2002.
[53] ADNOC Manual of Codes of Practice: '*Guideline on Occupational Health Risk Assessment (OHRA)*', ADNOC-COPV3-08.

- Require contractors to adopt the guidance, recommendations and instructions contained in the UK Health and Safety Executive Diving Safety Memoranda).
- Require contractors to utilise underwater service industry accepted techniques to monitor and protect the health of divers. In this context "monitor" means to record both the time/depth exposure of divers and any chemical and physical factors which may be hazardous to health.
- Require diving contractors to demonstrate proper functioning of critical systems.
- Inspect/audit the personnel, equipment, procedures and controls against contract conditions.
- Require all diving operations to be carried out under appropriate Permit To Work procedures along with Task Risk Assessment.
- Ensure that the contractor provides evidence of an annual audit by a recognized independent third party auditor duly approved by ADNOC.

1.2 MANAGEMENT GUIDELINES

The range of activities which require to be executed by divers underwater is wide and diving involves a unique combination of occupational health and safety issues.

The purpose of this Section is to state the fundamental principles of the management of contracted diving services and to assist the management of ADNOC Group Companies in fulfilling their responsibilities to maintain high standards of health and safety, when involved in this specialised and multidisciplinary area.

ADNOC will follow the main international developments in diving, to ensure reliable input to future project developments and to identify those aspects with significant potential impact on underwater activities.

While every effort is being made to design out the need for diving - and remotely controlled systems are replacing some diver tasks - it is anticipated that diving will still be required for the foreseeable future.

Underwater activities in ADNOC Group of Companies are predominantly in the Exploration and Production area, and smaller scale activities occur in other areas, mainly in connection with ships, buoys, jetties and underwater pipelines. All require to be planned and controlled to high standards.

Diving is an unusual activity, in which it is required that personnel significantly change their physiology to go to work (inert gas solution in body tissues, thermal characteristics, voice, narcotic effects of raised gas partial pressure may all be involved) and from which state it may be impossible to return safely to atmospheric pressure without a delay of up to a few hours in some cases, or up to three or four days in deeper and/or larger scale operations.

Diving requires considerable specialised knowledge, skill and experience, and may be conveniently divided into the following activities:

- Transfer of the diver(s) to the work site and continuous maintenance of all life support functions and emergency arrangements
- The procedures required to permit safe return to atmospheric pressure without adverse physiological effects.
- The activities concerned with the underwater work required.

Diving should therefore be undertaken only by professional contractors, with scope of work, controls and deliverables required being managed by the Group Company.

It is difficult to generalise on the level of risk for various types of diving. However, from international statistics it is apparent that the number of serious diving related accidents has been higher in shallower waters (i.e. from the surface down to 50 m) than in deeper diving. It is noted that most diving operations in the ADNOC Group of Companies are within this 50m range.

2. DUTIES, RESPONSIBILITIES AND RELATIONSHIPS

2.1 Group Company Competent Person

Group Companies that require diving projects/operations for their existing operations, facilities and/or projects must have a formally appointed Competent Person for Diving Operations. His responsibilities comprise, amongst others:

- To ensure that competent Diving Contractors are employed.
- To coordinate with the line organisations in preparing plans for diving operations and ensuring that the appointed Diving Contractor operates within the agreed plans and contractual terms & conditions.
- To verify that the appointed Diving Contractor operates with acceptable standards for HSE as detailed in international diving codes and ADNOC HSE Codes of Practice.
- To approve any deviation from agreed standards that may be proposed by the Diving Contractor, as required by special circumstances and/or conditions.
- To compile diving statistics and report mishaps to ADNOC/EH&S - SPC (see Section 5.7).

The Group Company Competent Person for Diving Operations must be competent in understanding applicable diving procedures, regulations and codes of practice. In addition, he must have a good overview of the specific operations, facilities and environment that may affect the planned and ongoing diving operations.

It may be problematic for some Group Companies to maintain such expertise e.g. small companies and when only ad-hoc diving operations are carried out. Under such circumstances, ADNOC permits these Group Companies to rely on IRSHAD, whose resources are considered the ADNOC authority on diving operations. IRSHAD conduct the large majority of Diving operations throughout the ADNOC Group in the capacity of Diving Contractor. Such handover of responsibilities to IRSHAD must be documented.

Group Companies that use Diving Contractors other than IRSHAD must have their own Competent Person for Diving Operations, or alternatively, may employ IRSHAD to provide this specific resource.

2.2 Facility/Site Manager or Ships Master

The actions of others, even though they are not members of the diving team, can have a bearing on the safety of the diving operation. Such interfaces, must be managed carefully throughout the duration of the diving operation.

The Facility/Site Manager or Ship's Master, who is responsible for the area inside which diving work is to take place, must:

- Ensure that all such interfaces are identified, the risks analysed and actions taken to mitigate the risks. Such interfaces resulting from concurrent activities include, amongst others:
  - Overside lifting, scaffolding or any other work that may cause objects to drop in the diving zone.
  - Overside disposal of effluent and/or waste e.g. drilling mud/cuttings.
  - Ship movements in the vicinity of diving location e.g. supply ships.
  - Testing of firefighting facilities i.e. start-up of fire pumps.
  - Special operations that may cause accidental loss of containment in the vicinity of the diving operations e.g. pressure testing of subsea pipework, testing of subsea Emergency Shutdown Valves (ESDs).
- Ensure that, where possible, concurrent operations are avoided. However, if avoiding these is not an option, then Permit To Work (PTW) control requirements must be strictly applied which specifically address the mechanical or electrical isolation of such items, plant or equipment that are under operations control and may cause a hazard to the diving team. These should include e.g. water intakes or discharge points causing suction or turbulence, gas flare mechanisms that may activate without warning or equipment liable to start operating automatically [Ref. 2].
- Inform the Diving Contractor of the location and exact operational details of all interface items in writing and in sufficient time to account for them in the risk assessments.
- Provide the Diving Contractor with details of any possible substance likely to be encountered by the diving team that would be a hazard to their health, e.g. drill cuttings on the seabed, including relevant risk assessments for these substances. This information must be provided in writing and in sufficient time to allow the Diving Contractor to carry out the relevant risk assessments.
- Provide sufficient time and facilities to the Diving Contractor at the commencement of the diving job/project in order to carry out all necessary site specific safety and familiarization training.
- Extend facilities and all reasonable support to the Diving Contractor or Diving Supervisor in the event of an emergency. Details of the agreed emergency response arrangements must form part of the planning for the diving project.
- Appoint an on-site operations representative, who is available at all times to coordinate with the Diving Supervisor. Such an operations representative must have the necessary knowledge of operations systems/facilities as well as the basic knowledge of diving operations to be competent for this task.

[2] Protection of Water Intake Points for Diver Safety, AODC 055, Association of Offshore Diving Contractors (now IMCA).

- If diving work is performed under contract with another contractor (main contractor), who carries work for the Group Company, and such main contractor oversees the work of the Diving Contractor according to the contract, it is recommended that the main contractor should also appoint an on-site representative. Similarly, such a person must have the necessary experience and knowledge to be competent for this task.
- Verify, as far as it is reasonable, that the Diving Contractor has the appropriate plant and equipment, personnel and operating procedures to meet any relevant regulations before diving work begins.
- Ensure that the Diving Supervisor is kept informed of any changes that may affect the diving operation, e.g. vessel movements, deteriorating weather, etc. Also see Section 6.3.

Prior to commencing the diving operations, all parties must be informed that:

- The Facility/Site Manager or Ship's Master and/or the appointed operations representative, may prevent a dive commencing and order the termination of a dive on the grounds of safety
- Only the Diving Supervisor can order a dive to commence).

2.3 Diving Contractor

On any diving project/operation, there needs to be one company in overall control of the diving operations. This will normally be the company who employs the divers. If there is more than one company employing divers then there must be a written agreement as to which of these companies is in overall control. The company in control is called the Diving Contractor.

The name of the Diving Contractor must be clearly displayed and all personnel, clients and others involved in the diving operation must be aware who the Diving Contractor is.

The Diving Contractor must provide a defined management structure in writing. This must include arrangements for a clear hand over of supervisory responsibilities at appropriate stages in the operation, again recorded in writing.

The Diving Contractor's responsibilities must include provisions to ensure that:

- Risk assessments have been carried out both onshore and at site.
- The place from which operations are to be carried out is suitable and safe.
- There are sufficient personnel of the required competency in the diving team.
- The personnel are qualified and competent. Divers must be medically qualified for using breathing apparatus/equipment for diving and certified by accredited institute for diving operation.

- Suitable plant and equipment is supplied.
- The plant and equipment is correctly certified and properly maintained.
- A suitable plan is prepared which includes emergency and contingency plans. This must be signed and dated by the person preparing it.
- Suitable site specific safety and familiarization training is provided to all members of the dive and support teams.
- Project records are kept of all relevant details of the project, including all dives.
- Adequate arrangements exist for first aid and medical treatment of personnel.
- There is a clear reporting and responsibility structure laid out in writing.
- Supervisors are appointed in writing and the extent of their control documented.
- All relevant regulations are complied with.

The level of detail or involvement required of the Diving Contractor, and information on how to meet the responsibilities, are given in the relevant sections of this Code of Practice.

2.4 Diving Supervisor

Diving Supervisors are responsible for the operation that they have been appointed to supervise, and they must only hand over control to another supervisor appointed in writing by the Diving Contractor. Such a handover must be entered in the relevant operations logbook.

Diving Supervisors can only supervise as much of a diving operation as they can personally control both during routine operations and if an emergency should occur.

The Diving Supervisor with overall responsibility for the operation is the only person who can order the start of a dive, subject to appropriate work permits etc. Other relevant parties, such as a ship's Master or the Installation Manager, can, however, tell the Diving Supervisor to terminate a dive for safety or operational reasons.

There will be times, for example, during operations from a vessel using dynamic positioning techniques that the Diving Supervisor will need to liaise closely with other personnel, such as the vessel Master or the DP operator. In such circumstances, the Diving Supervisor must recognize that the vessel Master has responsibility for the overall safety of the vessel and its occupants.

The Diving Supervisor is entitled to give direct orders in relation to health and safety to any person taking part in, or who has any influence over, the diving operation. These orders take precedence over any company hierarchy. These orders could include instructing unnecessary personnel to leave a

control area, instructing personnel to operate equipment, etc. This authority does not extend to the duties of the Master of the vessel.

To ensure that the diving operation is carried out safely, Diving Supervisors must consider a number of points including:

- They are competent to carry out such work, and that they understand their own areas and levels of responsibility and who is responsible for any other relevant areas. Such responsibilities must be contained in the relevant documentation. They must be in possession of a letter from the Diving Contractor appointing them as a Diving Supervisor.
- The personnel they are to supervise are competent to carry out the work required of them. This includes that personnel are fit and in possession of a valid medical certificate of fitness.
- Equipment they propose to use for any particular operation is adequate, safe, properly certified and maintained. They can do this by confirming that the equipment meets the requirements set down in this COP. Equipment is adequately checked by themselves or another competent person prior to its use. Such checks must be documented, for example, on a pre-prepared checklist, and recorded in the diving operations log for the project.
- When the operation uses, or plans to use, complex or potentially hazardous equipment, they must ensure that the possible hazards have been evaluated and are fully understood by all relevant parties and that, if required, training is given. This must be carried out as part of the risk assessment during the planning of the operation and must be documented. If the situation changes, further risk assessment must be considered. Diving Supervisors must meet their responsibilities by ensuring the documentation exists and following any guidance contained in the documentation, e.g. manufacturer's instructions.
- The operation they are being asked to supervise complies with the requirements of this COP. Detailed advice on how they can ensure this is given in various sections of this COP.
- All involved parties are aware that a diving operation is going to start or continue. Obtain any necessary permission before starting or continuing the operation, normally via a Permit To Work (PTW) system.
- Have clear, audible and, where practicable, visual communications with any personnel under their supervision. For example, a Diving Supervisor will be able to control the raising and lowering of a diving bell adequately if there is a direct audio link with the winch operator, even though the winch may be physically located where the supervisor cannot see it or have ready access to it.
- During saturation or bell operations, Diving Supervisors must be able to see the divers inside the bell or compression chamber. This will normally

by achieved on the surface by means of direct viewing through the view ports but when the bell is under water this must be by means of an internal camera.

- Direct communications with any diver in the water at all times, even if another person needs to talk to, or listen to, the diver [Ref. 3].

- Comprehensive Task Risk Assessment shall be carried out prior to commencement of the jobs.

[3] Communications with Divers, AODC 031, Association of Offshore Diving Contractors (now IMCA).

3. EQUIPMENT

3.1 Equipment Location and Integrity

The choice of equipment location will be determined by the type of installation (a fixed structure may differ from a vessel), the detail of the type of diving equipment involved, the integrity of any handling system with respect to lifting points or load bearing welds, and structures etc. In this respect, it must be ensured that current test certificates for all equipment are available where / or when required.

In some applications the diving system may be required to operate in a hazardous area (i.e. an area in which there is the possibility of danger of fire or explosion from the ignition of gas, vapour or volatile liquid). All diving equipment used in such an area must comply with the safety regulations for that area.

Diving Supervisors must comply with any specific site requirements and where required obtain an appropriate permit-to-work before conducting diving operations.

Equipment location is often dependent on available deck space. However, placing the diving deployment system close to a ship's center of gravity will minimize motion.

The power source for the diving system may be independent of the surface platform or vessel's power supply. If this is by a separate generator, the positioning of this should be governed by the following factors: vibration, noise, exhaust, weather, length of cable required, possible shutdown phases, fire protection and ventilation.

Before welding any part of the diving system to a ship's or installation's deck, the position of fuel tanks and any other possible problem must be ascertained.

Normal practice will be to prepare a deck layout or plan prior to mobilization in order that a suitable equipment location and the service connections required are clear to all parties.

3.2 Gases

3.2.1 Storage Cylinders

Gases stored in cylinders at high pressure are potentially hazardous. The dive plan needs to specify that the gas storage areas need to be adequately protected by, for example, the provision of fire deluge systems. All gases used offshore must be handled with appropriate care.

Gas cylinders must be suitable in design, fit for purpose and safe for use. Each cylinder must be tested and have appropriate certification issued by a competent person.

Cylinders used for diving within the scope of this COP may be subjected to special conditions, such as use in salt water, and will therefore need special care [Ref. 4, 5, 6].

3.2.2 Marking and Colour Coding of Gas Storage

The Diving Contractor must ensure that all gas storage units comply with a recognized and agreed standard of colour coding and marking of gas storage cylinders, quads and banks. Where appropriate, pipe work must also be colour coded (all gases must be analysed before use in any case).

3.2.3 Diver's Breathing Gas Supply

The correct use of breathing gases for divers and the continuity of their supply is vital to diver's safety and health. Total or partial loss or interruption of diver's breathing gas supply can be fatal. Equipment will be needed to supply every diver, including the standby diver, with breathing gas of the correct composition, suitable volume, temperature and flow for all foreseeable situations, including emergencies. In particular the supply must be arranged so that no other diver (including the standby) is deprived of breathing gas if another diver's umbilical is cut or ruptured [Ref. 7].

Each diver in the water must carry a reserve supply of breathing gas that he can quickly switch into the breathing circuit in an emergency. This must have sufficient capacity to allow the diver to reach a place of safety.

An in-line oxygen analyser with an audible Hi-Lo alarm must be fitted to the diver's gas supply line in the dive control area, where gas means any other breathing medium other than natural compressed air. This will prevent the diver being supplied with the wrong percentage of oxygen even if the breathing medium is compressed air. In addition, a carbon dioxide analyser must be fitted in all saturation operations using gas reclaim equipment.

3.2.4 Emergency Air Cylinders

When a diving basket is used by surface-supplied divers, emergency breathing gas cylinders must be supplied in the basket in a standard, agreed layout. This enables the divers to access the cylinders rapidly in an emergency [Ref. 8].

3.2.5 Oxygen

Any gas mixture containing more than 25% oxygen by volume must be handled like pure oxygen. It must not be stored in a confined space or below decks but out in the open, and protected as detailed in Sections 3.2.1 and 3.2.2.

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[4] Gas cylinders used in conjunction with diving operations in areas governed by UK Regulations, AODC 010 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
[5] Periodic Examination of bail-out bottles, AODC 037, Association of Offshore Diving Contractors (now IMCA).
[6] Ingress of Water into Underwater Cylinders charged by means of a Manifold System, AODC 064, Association of Offshore Diving Contractors (now IMCA).
[7] Diver's Gas Supply, AODC 028, Association of Offshore Diving Contractors (now IMCA).
[8] Emergency air bottles in diving baskets, AODC 039, Association of Offshore Diving Contractors (now IMCA).

Any materials used in plant which is intended to carry oxygen must be cleaned of hydrocarbons to avoid explosions. Formal cleaning procedures for such equipment must be provided by the Diving Contractor, together with documentary evidence that such procedures have been followed [Ref. 9].

3.2.6 All equipment for breathing air shall be meeting requirements of International Standards and certified quality. The maintenance shall be carried out by authorised and certified person only.

3.3 Diver Communications

All divers in the water must have a communication system that enables direct, two-way, voice contact with the Diving Supervisor on the surface. Speech processing equipment must be provided for divers who are breathing gas mixtures containing helium, which distorts speech. ***All such communications must be recorded***, and the recording kept until the dive is successfully completed. If an incident occurs during the dive, the communication record must be retained for any subsequent investigation.

Experience has shown that medical incidents may not become apparent for some hours after the actual dive is completed. Therefore, recordings must be kept for 24 hours before being erased. ***Wherever practicable, dives should also be video taped preferably via a head mounted camera so as to keep the divers hands free. A monitor for the Diving Supervisor should be provided*** (also refer section 7.3).

3.4 Diving Bells

3.4.1 Breathing Mixture Supply

The main umbilical system of a diving bell must be fitted with suitable protective devices that prevent uncontrolled loss of the atmosphere inside the diving bell if any or all of the components in the umbilical are ruptured [Ref. 10].

3.4.2 Emergency Recovery

The dive plan must identify adequate equipment and procedures to enable the diving bell to be rescued if the bell is accidentally severed from its lifting wires and supply umbilical [Ref. 11]. The bell must be equipped with a relocation device using the internationally recognized frequency to enable rapid location if the bell is lost. It must be fitted with the internationally agreed common manifold block for attachment of an emergency umbilical [Ref. 11, 12]. The bell must be capable of sustaining the lives of trapped divers for at least 24 hours [Ref. 11, 13].

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[9] Oxygen Cleaning, AODC 029, Association of Offshore Diving Contractors (now IMCA).
[10] Emergency isolation of gas circuits in the event of a ruptured bell umbilical, AODC 009, Association of Offshore Diving Contractors (now IMCA).
[11] Guidance Note on emergency diving bell recovery, AODC 019 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
[12] Bell emergency location equipment trials, AODC 012, Association of Offshore Diving Contractors (now IMCA).
[13] Diver emergency heating, AODC 026, Association of Offshore Diving Contractors (now IMCA).

The bell must have an alternative way to return to the surface if the main lifting gear fails. This is normally by means of the guide wires and their lifting equipment or could be by means of an ROV attaching a new lift wire. However, if weight shedding is employed, the weights must be designed so that the divers inside the bell can shed them. The design must ensure that the weights cannot be shed accidentally [Ref. 14].

3.4.3 Equipment Level

Closed diving bells used for saturation or bounce diving must have the following minimum level of equipment and facilities:

- Divers must be able to enter and leave the bell without difficulty.
- Lifting equipment to enable a person in the bell to lift an unconscious or injured diver into the bell in an emergency.
- Divers must be able to transfer under pressure from the bell to a surface compression chamber and vice versa.
- Bell door that can be opened from both sides and that act as a pressure seal.
- Valves, gauges and other fittings (made of suitable materials) to indicate and control the pressure within the bell. The external pressure must be indicated to both the divers in the bell and the Diving Supervisor.
- Adequate equipment, including reserve facilities, to supply an appropriate breathing mixture to divers in, and working from, the bell.
- Equipment to light and heat the bell.
- Adequate first-aid equipment.
- Lifting gear to lower the bell to the depth of the diving project, maintain it at depth, and raise it to the surface, without the occurrence of excessive lateral, vertical or rotational movement.

3.5 Emergency Markings on Hyperbaric Rescue Systems

In an emergency, it is possible that personnel with no specialized diving knowledge will be the first to reach a hyperbaric rescue system. To ensure that rescuers provide suitable assistance and do not accidentally compromise the safety of the occupants, an IMO standard set of markings and instructions has been agreed [Ref. 15]. Such markings must be clearly visible when the system is afloat. These markings must be provided in English and Arabic.

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[14] Bell Ballast Release Systems and Buoyant Ascent in Offshore Diving Operations, AODC 061, Association of Offshore Diving Contractors (now IMCA).
[15] Guidance Note on the marking of hyperbaric rescue systems designed to float in water, AODC 017, Association of Offshore Diving Contractors (now IMCA).

3.6 Electricity

Divers and others in the dive team are required to work with equipment carrying electric currents, which presents the risk of electric shock and burning. Procedures have been developed for the safe use of electricity under water, and any equipment used in a diving operation must comply with this guidance [Ref. 16 and 17].

3.7 Suitability

The Diving Contractor must ensure that the equipment provided for the diving project is suitable for the intended use, in all foreseeable circumstances on the project. Suitability can be assessed by the evaluation of a competent person, clear instructions or statements from the manufacturer or supplier, physical testing or previous use in similar circumstances.

New, or innovative, equipment must be considered carefully, but should not be discounted because it has not been used before.

3.8 Certification

The standards and codes used to examine, test and certify plant and equipment, and the requirements of those who are competent to carry out such examinations, tests and certification, have been established [Ref. 18]. All equipment and plant supplied for use in a diving operation must comply with at least these standards. Suitable certificates (or copies) must be provided at the worksite for checking.

3.9 Man-Riding Handling Systems

Particular safety standards must be applied when using lifting equipment to carry personnel because serious injury may result from falling. Such handling systems must be designed with a suitable minimum safety factor on the load. Alternative design factors may be considered if based on detailed analysis, such as computer modelling of support ship motions, etc.

3.9.1 Winches

Both hydraulic and pneumatic winches need suitable braking systems, providing primary and secondary protection. They are not to be fitted with a pawl and ratchet gear in which the pawl has to be disengaged before lowering.

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[16] Codes of Practice for the safe Use of Electricity Under Water, AODC 035, Association of Offshore Diving Contractors (now IMCA).
[17] Prevention of Explosions during Battery Charging in relation to Diving Systems, AODC 054, Association of Offshore Diving Contractors (now IMCA).
[18] Codes of Practice in the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment - in accordance with UK Regulations, IMCA D018, International Marine Contractors Association.

3.9.2 Diving Baskets and Open-Bottom Bells

A basket or open-bottom bell, used in support of surface-supplied diving, must be able to carry at least two divers in a comfortable position. It must be designed with a chain or gate at the entry and exit point to prevent the divers falling out, and with suitable hand holds for the divers. The design must also prevent spinning or tipping, protect the divers from falling objects and carry sufficient breathing media for emergency purposes [Ref. 8].

3.9.3 Lift Wires

Particular selection criteria must be used for man-carrying lift wires, including wires intended for secondary or back-up lifting. These wires must have an effective safety factor of 8:1, be non-rotating, and be as compact as possible to minimize the space requirements of their operating winches.

3.9.4 Surface Diver Deployment and Recovery

Surface divers must not be expected to climb more than 3 meters up a ladder, and where the distance is 5 meters or more (from water level to landing area), a second mechanical recovery system must be provided.

3.10 Medical / Equipment Locks and Diving Bell Trunks

The inadvertent release of any clamping mechanism holding together two pressurized units under internal pressure may cause fatal injury to personnel both inside and outside the units. All such clamps must have pressure indicators and interlocks to ensure that they cannot be released while under pressure.

3.11 Therapeutic Recompression

No diving operation within the scope of this COP is to be carried out unless at least a two-compartment chamber is at the worksite, to provide suitable therapeutic recompression treatment [Ref. 19].

3.11.1 Recompression chambers

- Surface diving DDC's shall be twin compartment type designed to BS5500 Category 1 or equivalent.
- The minimum internal diameter must be 1372 mm (54 inches) and the main chamber must contain two off floor bunks which must be long enough to accommodate the divers in the fully reclined position.
- The chamber must be located in an air-conditioned environment, which must include the operator's station.
- Overboard O_2 dumps must terminate outside the container.

[8] Emergency air bottles in diving baskets, AODC 039, Association of Offshore Diving Contractors (now IMCA)
[19] Proximity to a recompression chamber after surfacing, DMAC 22, Diving Medical Advisory Committee, IMCA.

- All chambers shall have originally been constructed by a fabricator approved by an internationally recognized certifying authority and be fitted-out to the standard specified in that authorities "Rules for Certification and Construction of Diving Systems". The Contractor must provide proof of compliance with this requirement or alternatively have the chamber recertified by a recognized certifying authority.
- Internal main pressurization and depressurization valves must be fitted with isolating valves (regardless of NRV's).
- Saturation diving DDCs shall have a minimum diameter of 2 meters.

3.12 Maintenance of Diving Equipment

Diving plant and equipment is used under extreme conditions, including frequent immersion in salt water. Therefore, it requires regular inspection, maintenance and testing to ensure it is fit for use, e.g. that it is not damaged or suffering from deterioration.

3.12.1 Periodic Examination, Testing and Certification

Detailed guidance exists on the frequency and extent of inspection and testing required of all items of equipment used in a diving project, together with the levels of competence required of those carrying out the work [Ref. 18].

3.12.2 Planned Maintenance System

The Diving Contractor must establish a system of planned maintenance for plant and equipment to demonstrate compliance with this COP. Such a system may be based on either passage of time or amount of use, but ideally will be based on a combination of both.

For each major unit, the system must identify the frequency with which each task is to be undertaken and who should do the work. The individual involved must complete a record of the work, either on paper or computer.

3.12.3 Equipment Register

An equipment register must be maintained at the worksite, with copies of all relevant certificates of examination and test. It shall contain all relevant additional information, such as details of the materials used to construct diving bells and surface compression chambers. It must also need to contain details of any applicable design limitations, for example, maximum weather condition for use, if applicable.

[18] Codes of Practice in the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment - in accordance with UK Regulations, IMCA D018, International Marine Contractors Association.

3.12.4 Cylinders Used Under Water

Diver's emergency gas supply cylinders (bail-out bottles) and cylinders used under water for back-up supplies on diving bells and baskets can suffer from accelerated corrosion. Particular care must be taken to ensure that they are regularly examined and maintained [Ref. 4, 5, 6, 18].

3.12.5 Diving Bell and Basket Lift Wires

Frequent immersion in salt water, shock loading from waves, passing over multiple sheaves, etc., can cause wear and deterioration to the lift wires of diving bells and baskets if they are not properly maintained. Specialised advice on maintenance exists and must be followed to ensure that wires remain fit for purpose.

3.12.6 Lift Bags

Special requirements for the periodic examination, testing and certification of lift bags have been established. Manufacturer's maintenance instructions and testing requirements must be followed [Ref. 20].

3.13 Lifting Equipment Design, Test and Examination Requirements

All lifting equipment must examined by a 'competent person' before the equipment is used for the first time, after installation at another site and after major alteration or repair. Regular examination every six months is also recommended. Any additional testing specified should be at the discretion of the 'competent person'.

Any lifting cable or wire must be provided with a test certificate confirming its Safe Working Load (SWL). The SWL must never be exceeded during operations and must include the deployment device, the number of divers to be deployed (with all their equipment) and any components that hang from the lifting cable (including cable weight in air). The condition and integrity of the cable must be checked at six monthly intervals, or more frequently as circumstances dictate.

The lifting and lowering winch must be rated by the manufacturer for a safe working load at least equal to the weight of the deployment device plus divers in air plus any additional components. An overload test of the winch's lifting and braking capacity must be undertaken after:

- All permanent deck fixing are in place.
- NDT on relevant welds have been completed.

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[4] Gas cylinders used in conjunction with diving operations in areas governed by UK Regulations, AODC 010 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
[5] Periodic Examination of bail-out bottles, AODC 037, Association of Offshore Diving Contractors (now IMCA).
[6] Ingress of Water into Underwater Cylinders charged by means of a Manifold System, AODC 064, Association of Offshore Diving Contractors (now IMCA).
[18] Codes of Practice in the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment - in accordance with UK Regulations, IMCA D018, International Marine Contractors Association.
[20] Underwater Air Lift Bags, IMCA D016 (Rev. 1), International Marine Contractors Association.

All lifting gear such as sheaves, rings, shackles and pins must have test certificates when supplied and be examined at six monthly intervals thereafter. The certificates must show the SWL and the result of load tests undertaken on the components to 2 x SWL.

3.14 Warning Notices and Signals

Diving signals must be displayed in the most conspicuous position relative to the diving operation. The area of the diving operation must be clearly defined with the international flag 'A' '*Diver Below*' (see Fig 1) and where applicable mast head lights (see Fig. 2) or mast head symbols, (see Fig. 3).

In no-wind situations a rigid replica of the International Flag 'A', minimum dimension one square metre, must be displayed adjacent to the diving site.

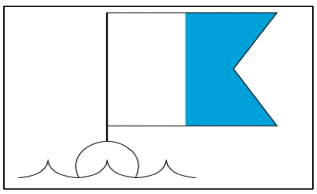

Figure 1: International Flag 'A' (Diver Below)

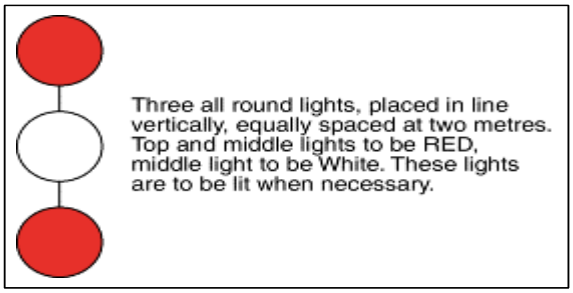

Figure 2: International Mast Head Lights

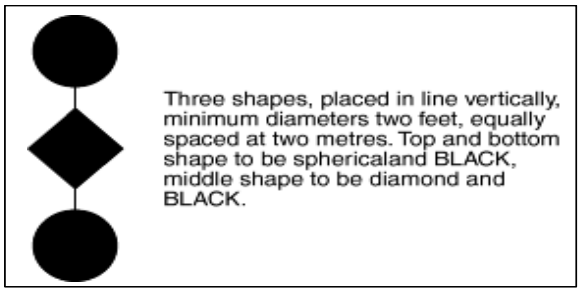

Figure 3: International Mast Head Symbols

4. PERSONNEL

This section refers to the number of divers and support personnel, their grades, competence and qualifications, and their ability to run the planned dive safely, including carrying out contingency and emergency plans.

4.1 Training and Competence

Competence may not be the same as qualification. A person who has a particular qualification, such as a diver training certificate, must have a certain level of competence in that area, but the Diving Contractor and the Diving Supervisor must satisfy themselves that the person has the detailed competence necessary to do the specific task required during the particular diving operation. This will normally mean establishing that the person has had sufficient training coupled with experience. In some cases, experience alone will indicate competence even if no formal training has been undertaken.

The different members of the diving team will require different levels and types of competence.

4.1.1 Tenders

Tenders are there to help the divers. They must be competent to provide the level of assistance that the diver expects and needs.

Competence is required of tenders in that:

- They understand the diving techniques being used. This includes a detailed knowledge of the emergency and contingency plans to be used.
- They are fully familiar with all of the diver's personal equipment.
- They understand the method of deployment being used and all of the actions expected of them in an emergency.
- They understand the ways in which their actions can affect the diver.
- They understand line signals.

In cases where the tender is not a diver and may, in fact, be a member of the deck crew, then his competence must be established on the basis of previous experience supplemented, where appropriate, with any additional training which the Diving Contractor or Diving Supervisor feels is necessary.

4.1.2 Divers

Divers must possess a formal training certificate showing that they have attended a recognised school or have been trained in some other way.

All divers at work must hold a diving qualification suitable for the work they intend to do. They must have the original certificate in their possession at the site of the diving project - copies must not be accepted.

A suitable diving qualification is not required by people such as medical staff who may be exposed to pressure in chambers but who are not divers. They must, however, need to pass the diver's medical restricted for exposure to pressure in a chamber. In an emergency such medical staff requested to enter a chamber may do so even without a valid medical certificate.

Only two grades of diver are allowed to work within the scope of this COP: **surface-supplied divers** and **closed bell divers**. The following certificates and qualifications are recognised for the two grades:

Surface-supplied diver certificates

1. HSE Surface Supplied (with offshore top up).
2. HSE Part I.
3. Transitional Part I (issued between 1/7/81 - 31/12/81).
4. TSA or MSC Basic Air Diving .
5. Norwegian NPD surface diver.
6. Dutch Part 1- Surface Dependent Diver.
7. French Class 2.
8. Australian Diver Accreditation Scheme Part 3.
9. Canadian Category 1 Diver
10. Canadian Surface Supplied Mixed Gas Diver to 70m.
11. Canadian Unrestricted Surface Supplied Diver to 50m.
12. New Zealand Part I.
13. South African Class 2.
14. IMCA Surface Supplied Diver.

Closed bell diver certificates

1. HSE Part II.
2. HSE Closed Bell.
3. Transitional Part II (issued between 1/7/81 - 31/12/81).
4. TSA or MSC bell diving.
5. Norwegian NPD Bell Diver.
6. Dutch Part 2 - Bell Diver.
7. French Class 3.
8. Australian Diver Accreditation Scheme Part 4.
9. Canadian Category 2 Diver.
10. Canadian Category 3 Diver.
11. Canadian Bell Diver.
12. New Zealand Part 2.
13. South African Class 1.
14. IMCA Bell Diver.

Those with one of the Closed Bell certificates listed above are also qualified to undertake surface-supplied activities.

Divers trained in the USA will not normally possess one of the certificates listed above. The US training system is based on a diver receiving basic training at a diving school followed by experience gained in the field under a form of "apprenticeship". Within this framework, a system is in existence whereby five US based schools are recognized by the Association of Commercial Diving Educators (ACDE) as giving a minimum standard of training to US Standard ANSI/ACDE -01-1998 (which replaced the previous standard ANSI/ACDE -01-1993). These schools are:

- The Ocean Corporation, Houston, Texas.
- Divers Academy Of the Eastern Seaboard Inc., Cýamden, New Jersey.
- College of Oceaneering, Los Angeles, California.
- Divers Institute of Technology Inc., Seattle, Washington.
- Santa Barbara City College, Santa Barbara, California.

These schools are independently audited and certificates from them can be accepted as showing suitable basic training. Subsequent diving experience must be demonstrated by log book entries.

Other certificates

- ADC Inc. is in the process of establishing a certification scheme for US trained divers and this scheme, once finalized, may also provide evidence of basic training.
- Military diving qualifications will not be suitable qualifications for diving within the scope of this Code of Practice.
- Other schools and training organizations award certificates to divers, some of which are said to be "equivalent" to HSE / NPD or similar. ADNOC is unable to say that these certificates are suitable and as such they are be deemed to be unacceptable.
- Sport diving certificates, such as BSAC or PADI, are not acceptable qualifications for offshore commercial diving.

None of these certificates in themselves prove competence, since the standards of training may vary considerably, but evidence of training, coupled with subsequent experience, will allow a reasonable decision to be made about a person's competence.

The diver needs to be competent in several different areas simultaneously:

- To use the diving techniques being employed. This includes breathing gas, personal equipment and deployment equipment.
- To work in the environmental conditions. This must include wave action, visibility and current effects.
- To use any tools or equipment they need during the course of the dive.

- To carry out the tasks required of them. This will normally require them to understand why they are doing certain things and how their actions may affect others.

Where a diver has not carried out a task before, or where a task may be new to every member of the diving team, competence can be gained by detailed review of drawings and specifications, the equipment to be operated under water, the area to be worked in and any other relevant factors. The time required for this review, the depth of detail reviewed and the checks necessary to confirm competence, will depend on the complexity of the task involved and the hazards associated with the operation.

4.1.3 Deck Crew / Riggers

Divers rely heavily on the support given to them from the surface by the deck crew. The actions of the people on deck can have a major impact on the safety and efficiency of the work being carried out under water.

The deck crew must be competent in a number of areas, e.g.:

- They must understand and be familiar with good rigging practice and seamanship. This must include relevant knots, slinging, correct use of shackles etc.
- They must be familiar with safe working loads and safety factors.
- They must understand the task that the diver is being asked to carry out under water.
- They must understand the limitations of a diver in relation to the work they can carry out. For example they must understand that a diver cannot normally lift an item under water that took two men to carry on deck.
- They must understand the various ways in which equipment can be prepared on deck to ease the task of the diver under water.

Often the deck crew will be made up in large part of experienced divers who are not actually diving. In such a case, competence can be established quickly. In most cases, the Diving Supervisor, or someone acting on his behalf, must give at least a short explanation to the deck crew prior to each job, such that competence is assured.

With a larger deck crew, it will not be necessary for all members of the crew to have the same level of competence, provided they are closely overseen by a competent and experienced person.

4.1.4 Life Support Personnel

Life Support Technicians (LSTs) are specialized personnel who are responsible for the operation of the deck compression chamber, including stored high pressure gases, in saturation or closed bell diving. LSTs must have the necessary training certification issued by a competent authority, e.g. IMCA.

4.1.5 Supervisors

There is only one person who can appoint a supervisor for a diving operation and that is the Diving Contractor, who must consider a number of factors when appointing a Supervisor:

- Regarding qualifications, it is relatively simple to establish if a person is suitably qualified to act as a Supervisor. A recognised certification scheme for the main grades of supervisor has been running for some years, administered by IMCA [Ref. 21]. This scheme issues formal certification to individuals who meet the necessary requirements. For Offshore Diving Supervisors there are currently two levels of IMCA certificates available and any person being considered for appointment as a Supervisor must be in possession of the relevant certificate, i.e.

  1. **Air Diving Supervisor**

     An Air Diving Supervisor must have passed the relevant modules of the certification scheme and be qualified to supervise all surface diving operations including decompression in a deck chamber. Care must be taken that such an individual has the necessary competence if they are asked to supervise surface mixed gas diving operations, since the examination and training for Air Diving Supervisor does not include surface mixed gas diving techniques.

  2. **Bell Diving Supervisor**

     A Bell Diving Supervisor must have passed both air diving and bell diving modules of the certification scheme and be qualified to supervise all diving operations, including those in deck chambers.

  The Diving Supervisor certificates can only be issued by IMCA. Other such certificates issued by training organisations are not valid as Diving Supervisor's certificates.

  Diving Supervisors must be appointed in writing by the Diving Contractor.

- In addition to the above two levels of Diving Supervisors, IMCA recognises the ***Life Support Supervisor*** *for* Diving Contractor's Life Support Technicians (LST). These must have passed the LST module of the IMCA certification scheme and have completed a minimum 200 days working offshore at this grade, and are considered competent by the Diving Contractor to supervise the life support of divers living in, or being compressed or decompressed in a DDC.

  LSTs are not qualified to supervise the actual dive and are at all times subject to the authority of the Diving Supervisor. Similar to Diving Supervisors, Life Support Supervisors are to be appointed in writing by the Diving Contractor.

[21] Offshore diving supervisor and life support technician schemes, AODC 053 (Rev 1), Association of Offshore Diving Contractors (now IMCA).

- Supervisors do not normally require qualification in first aid, however the Diving Contractor must consider the role and requirements of the supervisor during a medical emergency.
- If a diving operation is being planned, which does not fall clearly in to the areas normally undertaken by that Diving Contractor, detailed consideration must be given to the most suitable qualification for the Supervisors to be selected.

Clearly the issue of competence is more subjective and the Diving Contractor needs to consider the operations being planned and the competence of any individual being considered for appointment as a Supervisor. The possession of the necessary qualification does not in itself demonstrate competence for any specific operation.

The Diving Contractor must consider the details of the planned operation, such as the complexity of the part of the operation the person is going to supervise, the equipment and facilities which will be available to the Supervisor, the risks which the Supervisor and divers may be exposed to and the support which would be available to the Supervisor in an emergency. After such consideration, a decision must be made whether one Supervisor can be responsible for all that is intended or whether more supervision is required.

Relevant previous experience supervising similar operations will demonstrate a suitable level of competence. However, if this has been gained with a different Diving Contractor, then checks must be made to establish the veracity of the claimed experience. For this purpose the log book maintained by the supervisor can be consulted and if necessary, the details checked with previous Diving Contractors.

If relevant previous supervisory experience of similar operations cannot be demonstrated due to unique features of the planned operation, or to the limited previous experience of the individual being considered, then the Diving Contractor must assess the relevant information available, consider the possible risks involved and make a decision as to the competence of the individual concerned.

4.2 Numbers of Personnel / Team Size

4.2.1 General Requirements

The Diving Contractor must specify the size of team based on the details of the project. For safe operation, this may need to include additional deck support personnel and other management or technical support personnel, such as project engineers or maintenance technicians.

The Diving Contractor must provide a sufficient number of competent and qualified personnel to operate all the equipment and to provide support functions to the diving team, rather than relying on personnel provided by others for assistance (e.g. clients, ship crews, etc.). **Six personnel are considered as a minimum team size (see Section 4.2.6).**

If for any reason, personnel who are not employed by the Diving Contractor are to be used in the diving team, they must be carefully considered for competence and suitability before being included. Such personnel can create a hazard to themselves and others if they lack familiarity with the contractor's procedures, rules and equipment.

There will be exceptions to this requirement, for example, when a diving system is installed long term on a DSV and there are suitable technicians employed by the vessel owner. In such circumstances, these personnel, whose principal duties may be associated with the diving or ships equipment, may form part of the diving team. Such an arrangement must be confirmed in writing, together with the responsibilities of these individuals.

The team size and composition must always be sufficient to enable the diving operation to be conducted safely and effectively. This means that a number of eventualities must be considered when deciding team size and make up including the following:

- Type of task.
- Type of equipment (air, saturation etc.).
- Deployment method.
- Location.
- Water depth.
- Operational period (e.g. 12 or 24 hours per day).
- Handling of any foreseeable emergency situations.

The overriding factor must always be the safety of personnel during operation and maintenance. It is the absolute responsibility of the Diving Contractor to provide a well-balanced, competent team of sufficient numbers to ensure safety at all times.

4.2.2 Supervision

When a dive is taking place, either a Diving Supervisor or a Life Support Supervisor must be in control of the operation at all times. For large projects, more than one supervisor may be needed on duty.

Even on a 12-hour operation a second Diving Supervisor will be required if continuous/back-to-back diving is considered. This allows one supervisor to take rest, comfort and meal breaks away from the stressful job of operating the control panel.

Each supervisor will only be able to provide adequate supervision of a defined area of operations, including dealing with foreseeable contingencies or emergencies.

On large projects, dedicated personnel may be required to provide safe management control. These personnel are often called senior supervisors or superintendents, and may or may not perform "hands-on" duties as part of the dive team.

4.2.3 Standby Divers

Whenever a diver is in the water, a standby diver must be in immediate readiness to provide any necessary assistance to the diver. The standby diver must be dressed to enter the water but need not wear a mask or helmet, although these have to be readily available.

For dives to depths greater than 60fsw, or involving decompression, one standby diver is required for every two divers in the water. For surface supplied diving, the standby diver must remain on the surface.

For dives to depths less than 60fsw and not involving decompression, the standby diver may be deployed as a working diver providing all of the following conditions are met (ref. US Navy Manual [53]):

a) The standby diver is doing the same job, at the same location as diver 1.

b) Prior to deploying the standby diver, the work area shall be determined to be free from hazards (e.g. suctions, discharges) by the first diver on the job site.

c) When working in ballast tanks or confined spaces, the standby diver may be deployed as a working diver, but both divers shall be tended by a third diver who is outside the confined space.

When using a closed bell, the standby diver must remain inside the bell. Another diver must be on the surface with equipment suitable for intervention within the surface diving range. This diver need not be dressed for diving provided the equipment is available, and may undertake other duties within the dive team while the bell is under water.

4.2.4 Tenders

For umbilicals that are tended from the surface, at least one tender is required for each diver in the water.

For umbilicals tended from a bell or basket, one tender is required for every two divers in the water.

4.2.5 Life Support

Competent and qualified personnel providing life support will be needed to look after divers living in saturation. When divers are in saturation, normally two life support personnel must to be on duty at all times.

A separate Life Support Supervisor may need to be appointed in writing by the Diving Contractor if the life support control is remote from the diving control. Saturation Diving Supervisors are qualified to act as Life Support Supervisor.

The controls of a Surface Compression Chamber (SCC) can be operated by any competent person under supervision. All divers are trained to operate an SCC and are thus competent, as are qualified life support technicians (LSTs).

4.2.6 Surface-Supplied Diving Team

The absolute minimum required to conduct a safe surface-supplied dive within the scope of this COP is six diving personnel i.e.:

- One Diving Supervisor,
- Two working divers,
- Two tenders for the working divers,
- One standby diver,

Not included in the above is the tender for the standby diver who, if required, may be resourced from the deck crew.

Additional personnel may be needed to operate or maintain specialized equipment such as winches, and to assist in an emergency.

4.2.7 Closed Bell Diving Team

An absolute minimum closed bell project requires two operations i.e.

1. One operation when the divers are in the bell or in the water under the control of a Diving Supervisor, **and**
2. A second operation under a Life Support Supervisor when the divers are in the saturation chambers.

The absolute minimum team required to conduct a safe closed bell dive within the scope of this COP **will be seven** diving personnel i.e.:

- One Diving Supervisor,
- One Life Support Supervisor,
- One Life Support Technician,
- Two divers inside the bell,
- One diver on the surface
- One tender for the surface diver.

4.2.8 Other requirements

With regard to safe working practices, a single person must not work alone when dealing with:

- High Voltage.
- Heavy Lifts.
- High pressure machinery.
- Potential fire hazards - welding, burning.
- Epoxy fumes etc.

Individuals in a diving team will often carry out more than one duty provided they are qualified and competent to do so and that their different duties do not interfere with each other. Overlapping functions must be clearly identified in procedures.

Trainees will often form part of the team but will not normally be allowed to take over the functions of the person training them unless that person remains in control, is present to oversee their actions, and the handover does not affect the safety of the operation.

4.3 Working Periods

It is recognized that long hours are sometimes required, but such circumstances must be exceptional and never planned. It should be remembered that accidents are more likely when personnel work long hours because their concentration and efficiency deteriorate and their safety awareness is reduced.

Work must be planned so that each person is normally asked to work for a maximum of 12 continuous hours, with breaks for meals, and is then given a 12-hour unbroken rest period between shifts.

Members of the diving team must not be asked to work, or be on standby, for more than 12 hours without having at least 8 hours of unbroken rest during the previous 16 hours. Similarly, the longest period a diver will be asked to work, and only in exceptional circumstances, will be 16 hours before being given 8 hours unbroken rest. This may be, for example, where a diving team has been on standby, but not diving, for a number of hours before diving is needed. In such cases, extreme care must be taken and allowance must be made for the effects of fatigue.

In saturation diving, the divers must be asked to undertake a bell run exceeding 8 hours from seal to seal. They must then need to be allowed at least 12 hours of unbroken rest.

Extended work periods offshore without a break reduce safety awareness. Work must therefore be planned so that personnel do not work offshore for long periods without being allowed break time onshore. These times may need to vary to suit operational needs or exceptional circumstances, but personnel must be given a reasonable onshore break related to the period spent offshore.

No person will be expected to work a 12-hour shift without a meal break taken away from their place of work. Personnel also need toilet and refreshment breaks during their shifts.

To allow for these breaks, the Diving Contractor must ensure that the planned work either has natural breaks (for example, during periods of strong tide) or that qualified and experienced personnel are available to act as relievers during breaks. This is particularly important in relation to supervisors whose responsibilities are often onerous and stressful. Any such handovers of responsibility must be recorded in writing in the diving operations log.

4.4 Training

Diving Contractors must ensure that their personnel receive safety and technical training in order to allow them to work safely and in line with all relevant legislation, or to meet specific contractual conditions or requirements.

4.4.1 Safety Training

Safety Training must include the following:

- Courses on survival, first aid and fire fighting;
- An installation or vessel-specific safety induction course on the hazards to be found at work and while responding to emergencies.
- Further task-specific safety training outlining any special hazards associated with the tasks being worked on including masters and deck foremen, on diving safety where it interfaces with diving operations.
- Refresher training at regular intervals.

4.5 Communications

In an emergency, personnel tend to revert to their own language. If team members do not speak the same language, this can cause an obvious hazard. The dive plan must state the language to be used during the project, and all team members must be able to speak to each other fluently and clearly at all times, particularly during emergencies.

5. MEDICAL

5.1 Medical Equipment

A minimum amount of medical equipment is required at a diving site to provide first aid and medical treatment for the dive team. This minimum will depend on the type of diving, but a standard list has been agreed [Ref. 22]. Diving medical specialists will then know what equipment and supplies are available when giving advice to a worksite.

Particular problems exist if a diver becomes seriously ill or is injured while under pressure. Medical care in such circumstances may be difficult and the Diving Contractor, in conjunction with their medical adviser, must prepare contingency plans for such situations. Recommendations are available concerning the specialized equipment needed [Ref. 23].

The location of first-aid equipment must be clearly identified by the international sign of a white cross on a green background.

5.2 Suitable Doctors

The physiology of diving and the problems encountered by an ill or injured diver are not subjects which most doctors understand in detail. For this reason, it is necessary that any doctor who is involved in any way with examining divers or giving medical advice in relation to divers has sufficient knowledge and experience to do so [Ref. 24].

The medical examiner who certifies a diver's fitness must have an understanding of the working environment of the diver, which is normally gained by undertaking an appropriate training course. Such a doctor, however, may be unable to give the necessary advice in relation to treatment of decompression sickness or other diving related injury

Some doctors, as a result of training and/or experience have the necessary knowledge to advice on suitable treatment of diving related injury. They are usually described as Diving Medical Specialists and must be approved by ADNOC and fit to be compressed [Ref. 23].

5.3 First-Aid Training and Competencies

Diving physiology and medicine forms an integral part of all diver training courses.

For diving within the scope of this COP, divers must refresh their qualification at appropriate intervals. Divers with recognized diving first-aid certificates may choose to complete a general first-aid course rather than a diving specific course, the curriculum of which must be equivalent to the UK-HSE First-Aid course.

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[22] Medical equipment to be held at the site of an offshore diving operation, DMAC 15 (Rev 1), Diving Medical Advisory Committee, IMCA.
[23] The provision of emergency medical care for divers in saturation, DMAC 28, Diving Medical Advisory Committee, IMCA.
[24] The training and refresher training of doctors involved in the examination and treatment of professional divers, DMAC 17, Diving Medical Advisory Committee, IMCA.

In addition, one member of the dive team who is not diving (other than the supervisor) must be trained to the level of "Diver Medic." In practice, this means that at least two team members who do not dive together, are trained as diver medics. This level of training will also require refresher training at regular intervals (normally every three years) that will comply with DMAC Training [Ref. 25].

For saturation diving, the diver medic may be a team member on the surface but must be qualified to go under pressure in an emergency.

5.4 Medical Checks

All divers at work must have a valid certificate of medical fitness to dive issued by an IMCA ME approved diving doctor or UK-HSE approved diving doctor (see note below). The certificate of medical fitness to dive is a statement of the diver's fitness to perform work under water and is valid for as long as the doctor certifies, up to a maximum of 12 months.

The medical examination looks at the diver's overall fitness for purpose. It includes the main systems of the body - cardio-vascular system, respiratory system, central nervous system and ears, nose and throat, capacity for exercise, vision and dentition.

* Note: IMCA now approves diving doctors as the UK-HSE have withdrawn their previous recognition of overseas diving doctors to conduct diving medicals under the HSE approved diving doctors scheme.

5.4.1 Responsibility of the Diver

Divers who consider themselves unfit for any reason, e.g. fatigue, minor injury, recent medical treatment, etc., must inform their Diving Supervisor . Even a minor illness such as the common cold or a dental problem can have serious effects on a diver under pressure, and must be reported to the Diving Supervisor before the start of a dive. Supervisors must seek guidance from their company or its medical adviser if there is doubt about a diver's fitness.

Divers who have suffered an incident of decompression illness must record details of the treatment they received in their log books. They must show this to the Diving Supervisor responsible for the first dive after the treatment in order that a check can be made of their fitness to return to diving [DMAC 13, Guidance on assessing fitness to return to diving after decompression illness, [Ref. 26]].

5.4.2 Responsibility of the Diving Supervisor

Before saturation exposure, the Diving Supervisor must ensure that the divers have had a medical examination within the previous 24 hours. This will confirm, as far as reasonably practicable, their fitness to enter saturation.

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[25] First aid training for divers and diving supervisors, DMAC 11, Diving Medical Advisory Committee, IMCA.
[26] Guidance on assessing fitness to return to diving after decompression illness, DMAC 13 (Rev 1), Diving Medical Advisory Committee, IMCA.

The medical examination must be carried out by a nurse or a diver medic. The content of the examination and the format of the written record must be decided by the divers to confirm that they are fit to dive, and if they have taken any medication. This will be recorded in the diving operations log.

5.5 Liaison with a Suitable Doctor

The dive plan and risk assessment must consider the situation where a diver is injured but a doctor is not available at the worksite. In such a circumstance, arrangements will be needed to allow personnel at the site to communicate over radio or telephone links with a diving medical specialist. It is the responsibility of the Diving Contractor to make arrangements, before any diving operation commences, with a suitably qualified and experienced doctor such that medical advice and treatment is available at any time to the diving personnel offshore. To avoid problems in an emergency situation, the specialist doctor must possess a valid offshore security pass.

Such an arrangement is normally the subject of a "standby" agreement with a doctor experienced in diving medicine and means that an emergency contact is available at all times for medical advice. This arrangement must be documented with the necessary details readily available offshore.

Part of the planning must be the pre-agreement of a suitable method of transferring medical information from worksite to doctor, for example, the Diving Medical Advisory Committee's aide memoir [Ref. 27].

All risk assessments and dive plans must account for the fact that a seriously ill or injured diver in a DDC cannot be treated as if he was at atmospheric pressure [Ref. 23].

If the required treatment cannot be administered by the personnel at the worksite, then trained medical staff and specialised equipment must be transported to the casualty. Treatment must be given to the injured diver inside the DDC. The diver must not be decompressed or transferred to any other location until in a stable condition.

5.6 Medical and Physiological Considerations

5.6.1 Diver Monitoring

For safety reasons, the dive plan must specify that supervisors must be able to monitor divers' breathing patterns and receive verbal reports from the divers of their condition [Ref. 28].

[27] Aide memoire for recording and transmission of medical data to shore, DMAC 01, Diving Medical Advisory Committee, IMCA.
[23] The provision of emergency medical care for divers in saturation, DMAC 28, Diving Medical Advisory Committee, IMCA.
[28] In water diver monitoring, DMAC 02, Diving Medical Advisory Committee, IMCA.

5.6.2 Seismic Operations and Sonar Transmissions

There are inherent problems for divers who are close to seismic operations or sonar transmissions [Ref. 29, 30]. If there is any possibility of sonar activity or seismic activity in the vicinity of a diving project, the dive plan must include parameters for the safety of the diver.

5.6.3 Decompression Illness after Diving

Divers are at risk of decompression illness (DCI) after diving. It is difficult to treat decompression illness if recompression facilities are not immediately available. The dive plan must specify that divers remain close to suitable recompression facilities for a set time following a dive [Ref. 19]. The chamber must be available onsite at all times See 3.11.

5.6.4 Flying after Diving

The dive plan must state that flying must be avoided for a specified time following a dive because of the decrease in pressure on the diver's body caused by increased altitude [Ref. 31].

5.6.5 Thermal Stress

The dive plan must specify ways in which divers can be maintained in thermal balance because excessive heat or cold can affect their health, safety and efficiency. For example, divers may be provided with suitable passive or active heating, such as thermal undergarments and a well-fitting "dry" diving suit, or a hot-water suit. Conversely, in very warm waters nothing more than cotton overalls may be required.

The dive plan must state that divers who breathe oxygen and helium mixtures will require active heating because of the high thermal conductivity of this breathing mixture, and that their inspired breathing gas will need active heating for dives deeper than 150 m.

5.6.6 Duration of Saturation Exposure

When planning a dive, consideration must be given to the previous saturation exposures of each diver and the time they have spent at atmospheric pressure since completing their last saturation dive.

Because of the effects of long periods under pressure on the diver's health, safety and efficiency, the dive plan must state that divers must not to be in saturation for more than a specified number of days (often 28) under normal circumstances, including decompression, and that they must be at atmospheric pressure for a specified period before starting another saturation [Ref. 32]. Such periods must be specified in conjunction with the Company Medical Adviser.

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[19] Proximity to a recompression chamber after surfacing, DMAC 22, Diving Medical Advisory Committee, IMCA.
[29] The effect of sonar transmissions on commercial diving activities, DMAC 06, Diving Medical Advisory Committee, IMCA.
[30] Safe diving distance from seismic surveying operations, DMAC 12, Diving Medical Advisory Committee, IMCA.
[31] Recommendations for flying after diving, DMAC 07, Diving Medical Advisory Committee, IMCA.
[32] Guidance on the duration of saturation exposures and surface intervals between saturations, DMAC 21 (Rev 1), Diving Medical Advisory Committee, IMCA.

5.6.7 Divers out of Closed Bells

Divers operating out of a closed bell over extended periods can suffer from dehydration. A diver spending over two hours out of a closed bell must be offered the opportunity to return to the bell and remove their breathing apparatus for a drink or other refreshments. While lack of food will not normally be a problem, a light snack when back at the bell can be helpful.

5.7 REPORTING OF THERAPEUTIC RE-COMPRESSION EVENTS

All such events must be reported to ADNOC/SPC Environment & Safety Division within 7 days of occurrence.

In addition, to allow for statistical analysis ADNOC/ EH&S Division -SPC must receive an annual report from each Group Company with:

- The total number of dives carried out during the year.
- The number of Therapeutic re-compression events that have occurred during the year.

Such annual reporting is incorporated in the safety statistics of the Group Company Annual HSE Letter as per the relevant Codes of Practice [Ref. 52].

[52] ADNOC Manual of Codes of Practice: '*Directions for preparing the Annual HSE Letter*'. ADNOC-COPV1-07.

6. WORK PLANNING

6.1 General

Before any diving is carried out there must be a dive plan in existence. The dive plan must consist of a Diving Contractor's standard operating rules and any site-specific risk assessments and procedures.

The plan must cover the general principles of the diving techniques as well as the needs of the particular operation. It must also provide contingency procedures for any foreseeable emergency.

Many factors have to be considered when preparing a dive plan for a diving project. The risk assessment must identify site-specific hazards and their risks. Based on this information, the plan must state how these hazards and risks can be controlled. An exhaustive list of hazards and risks is not possible but some are highlighted below.

All supervisors must have a copy of the dive plan.

6.1.1 Scuba

Self-Contained Underwater Breathing Apparatus (SCUBA) has inherent limitations and difficulties such as limited breathing gas supplies. It must not be used unless it can be proven that surface supplied equipment is a higher risk. Thus, it is unlikely that there will be any circumstances where the use of SCUBA will provide a suitable technique for diving under the scope of this COP [Ref. 33]. For Scientific, Archaeological, Environmental & Media Diving, see Section 9.

6.1.2 Use of compressed air or oxy-nitrogen mixtures

Divers breathing a mixture of oxygen and nitrogen under pressure, whether compressed natural air or an artificial mixture, are at risk of both oxygen toxicity and nitrogen narcosis as the depth increases. The dive plan must therefore specify the maximum depth for the mixture being used. Breathing mixtures other than oxygen and nitrogen (or air) will normally be used when diving takes place deeper than 50 m of water.

6.1.3 Exposure limits for air and oxy-nitrogen diving

Diving carries an inherent risk of decompression illness (DCI). The incidence of DCI drops if the length of time a diver spends at any particular depth is limited. Many Diving Contractors use an artificial limit on time at any depth, typically the US Navy "O" repetitive group, to reduce the chances of DCI.

However, and notwithstanding above, the dive plans for ADNOC Group Companies must be based on maximum bottom time limitation for surface decompression (SD) and in water decompression diving limits as set out in the Table 1.

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[33] SCUBA, AODC 065, Association of Offshore Diving Contractors (now IMCA).

Table 1: MAXIMUM BOTTOM TIME FOR SURFACE DECOMPRESSION AND IN-WATER DECOMPRESSION

Maximum Depth of Dive		Bottom Time in Minutes
Feet	Meters	SD & in water
0-40	0-12	240
50	15	180
60	18	120
70	21	90
80	24	70
90	27	60
100	30	50
110	33	40
120	36	35
130	39	30
140	42	30
150	45	25
160	48	25
170	51	20

Repetitive Diving

The practice of repetitive diving, using tables which utilize the principle of diminishing residual body nitrogen in relation to increasing surface intervals, is discouraged for routine diving operations. Regular repetitive diving of this nature generally results in higher residual nitrogen levels in the body and a subsequent increase in decompression sickness incidence. Also, when regular repetitive diving is required, it may indicate that the diving team size is insufficient.

Repetitive diving shall only be allowed if the Diving Contractor has its own approved operating procedures that comply with US Navy (USN) repetitive dive tables or any other approved decompression tables. Repetitive diving using USN repetitive dive tables shall never follow surface oxygen decompression.

If any USN type repetitive diving is conducted, then the Diving Supervisor must record in the diving operations log book his reason for allowing its use. As a guideline, repetitive diving should be restricted to exceptional circumstances e.g. in the case of an emergency or extreme urgency where there would be a serious possibility of injury or property damage if the dive was not conducted.

Combined Diving

The use of combined diving, using the combined bottom times and the deepest depth to select the appropriate decompression schedule, is permitted.

This is on the condition that in no event shall the combined time exceed the limitations of Section 6.1.3.

Combined diving remains a somewhat controversial issue in which many professional divers are satisfied that repetitive diving (using US Navy repetitive diving tables) is the safer option and is less open to personal interpretation. Combined diving is currently being reviewed by IMCA, and their future recommendations will be incorporated in this Code of Practice.

6.1.4 Surface supplied mixed gas diving

The Diving Contractor may wish to carry out work using surface supplied techniques but where the use of compressed air or oxy-nitrogen mixtures would not be appropriate. The normal solution is to use a mixture of helium and oxygen as the breathing gas. For such diving a properly equipped wet bell must be used and the maximum depth must be limited to 75 m of water for 30 minutes.

The dive plan for such work must consider all the relevant safety implications of using this technique instead of the use of a closed bell.

6.1.5 Water intakes and discharges

Divers are vulnerable to suction or turbulence caused by water intakes and discharges. The Diving Contractor must establish with the client whether there are any underwater obstructions or hazards in the vicinity of the proposed diving project. If there are any intakes or discharges, suitable measures must be taken to ensure that these cannot operate while divers are in the water unless the divers are protected with a suitable physical guard. Such measures must be part of a work control system such as a permit-to-work system, and could include mechanical isolation [Ref. 2].

6.1.6 Restricted surface visibility

Restricted surface visibility caused by driving rain for example may affect the safety of the operation. The dive plan must identify when operations will need to be suspended because of restricted visibility [Ref. 34].

6.1.7 Underwater Currents

The dive plan must consider the presence of currents and the limitations they impose on the diver's operational ability [Ref. 35]. While other parameters also need to be taken into account, tide meters provide accurate information on the current at different depths and can be used to assess the diving conditions.

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[2] Protection of Water Intake Points for Diver Safety, AODC 055, Association of Offshore Diving Contractors (now IMCA).
[34] Diving when there is poor surface visibility, AODC 034, Association of Offshore Diving Contractors (now IMCA).
[35] The effects of underwater currents on diver's performance and safety, AODC 047, Association of Offshore Diving Contractors (now IMCA).

6.1.8 Diving near ROV Operations

There are a number of safety considerations that need to be taken into account when divers are working with, or in the vicinity of ROVs. These include entanglement of umbilical, physical contact, electrical hazards, etc. The dive plan must include solutions for these hazards. For example, umbilicals could be restricted in length, and electrical trip mechanisms or guards could be employed [Ref. 16, 36, 37].

6.1.9 Safe use of electricity

Divers often come into contact with equipment operated by, or carrying electricity. Care must be taken, therefore, to ensure that the divers and other members of the dive team, are protected from any hazards resulting from the use of electricity and particularly from any shock hazards [Ref. 16].

Battery-operated equipment used inside compression chambers can also be a hazard and the dive plan must include safe parameters for using such equipment.

6.1.10 High-pressure water jetting

Even an apparently minor accident with this equipment has the potential to cause a serious internal injury to the diver. A dive plan that includes the use of such units must therefore also include safe operating procedures that are to be followed. Such procedures can be found in industry guidance [Ref. 38, 39].

6.1.11 Lift bags

The use of lift bags under water can be hazardous. The dive plan must include ways to prevent the uncontrolled ascent of a load. Good practice established by the industry must be followed [Ref. 20].

6.1.12 Abrasive cutting discs

The dive plan must address the risk of abrasive cutting discs breaking during use under water. In particular, the adhesive used in these discs tends to degrade in water. The plan must ensure that only dry discs not previously exposed to water are used, and that only enough discs for each dive are taken under water at any one time.

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[16] Codes of Practice for the safe Use of Electricity Under Water, AODC 035, Association of Offshore Diving Contractors (now IMCA).
[36] Remotely operated vehicle intervention during diving operations, AODC 032 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
[37] Guidance note on the safe and efficient operation of remotely operated vehicles, AODC 051, Association of Offshore Diving Contractors (now IMCA).
[38] Codes of Practice for the use of high pressure water jetting equipment by divers, AODC 049, Association of Offshore Diving Contractors (now IMCA).
[39] Accidents with high pressure water jets, DMAC 03, Diving Medical Advisory Committee, IMCA.
[20] Underwater Air Lift Bags, IMCA D016 (Rev. 1), International Marine Contractors Association.

6.1.13 Oxy-arc cutting and burning operations

There are inherent dangers in the use of oxy-arc cutting and burning techniques under water, including explosions from trapped gases, trapping of divers by items after cutting, etc. Guidance on this subject exists. The dive plan must include precise instructions regarding the operating procedures. Procedures, which eliminate blowback, etc., must be used [Ref. 16, 40].

6.1.14 Diving from DP vessels

Diving from dynamically positioned vessels can be hazardous to divers because of the presence of rotating propellers and thrusters. Practical steps have been established to reduce the risks arising from this hazard, and these must be included in the dive plan [Ref. 41].

The use of an ROV or some other way of carrying out the task must be considered if the possibility of an umbilical or diver coming into contact with a thruster or propeller cannot be discounted.

The dive plan must ensure that any diving support vessel operating on dynamic positioning meets industry technical and operational standards [Ref. 42, 43, 44].

6.1.15 Quantity of Gas

The likely quantities of gases needed for diving operations, including therapeutic treatment and emergencies, must be calculated when planning a diving project. Allowances must also be made for leakage, wastage, and contingencies. AODC 14 must be complied with for surface diving within 50 meters depth, the requirement for oxygen for emergency use must not fall below 60 cm^3 before a dive commences [Ref. 45]. Diving must be stopped if the minimum quantity of gas acceptable for safety purposes falls below the agreed minimum specified in the dive plan.

6.1.16 Levels of Oxygen in Helium

For safety reasons, pure helium must not be sent offshore except as a calibration gas or for a specific operational requirement. A small percentage of oxygen must be present in helium to be used within the scope of this COP. The minimum industry norm is 2% [Ref. 46, 47].

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[16] Codes of Practice for the safe Use of Electricity Under Water, AODC 035, Association of Offshore Diving Contractors (now IMCA).
[40] Oxy-arc cutting operations under water, IMCA D 003, International Marine Contractors Association.
[41] Diving operations from vessels operating in DP mode, IMCA D 010 (Rev 1), International Marine Contractors Association.
[42] Guidelines for the design and operation of dynamically positioned vessels, 103 DPVOA, Dynamic Position Vessel Owners Association, IMCA.
[43] Power system protection for DP vessels, 108 DPVOA, Dynamic Position Vessel Owners Association, IMCA.
[44] The training and experience of key DP personnel, IMCA M 117, International Marine Contractors Association.
[45] Minimum quantities of gas required offshore, AODC 014, Association of Offshore Diving Contractors (now IMCA).
[46] Recommendations on minimum level of O_2 in helium supplied offshore, DMAC 05, Diving Medical Advisory Committee, IMCA.
[47] Guidance note on the use of inert gases, AODC 038, Association of Offshore Diving Contractors (now IMCA).

When an oxygen-helium mixture is used as the reserve supply in the divers' bail-out bottle, it must contain a percentage of oxygen that allows it to be breathable over the largest possible depth range. Guidance on a suitable percentage exists [Ref. 48].

6.1.17 Contents of Gas Mixes

Gas cylinders containing breathing gases coming from suppliers must be colour coded in accordance with industry guidance and will be accompanied by an analysis certificate [Ref. 49]. The dive plan must make it clear that neither of these should be accepted as correct until a competent member of the dive team has analyzed at least the oxygen content. This analysis must be repeated immediately before use of the gas.

6.1.18 Length of Diver's Umbilicals

The required length of the diver's umbilical in relation to the worksite must be included in the dive plan, particularly where an emergency situation might require rapid location and recovery of the diver [Ref. 50].

When a diving bell is being used from a dynamically positioned vessel, the dive plan must consider the fouling and snagging hazards in relation to umbilical length [Ref. 41].

6.1.19 Duration of Bell Runs and Lockouts

The dive plan must limit bell runs to less than 8 hours from "lock-off" to "lock-on" because of decreased safety and efficiency. The dive plan must ensure that in a two-man bell, neither diver spends more than 6 hours out of the bell.

The dive plan must state that divers in saturation require at least 12 continuous hours of rest in each 24-hours period.

6.1.20 Transfer Under Pressure

The transfer of divers or equipment into or out of the saturation chamber, or between chambers under pressure, introduces a particular hazard. The dive plan must state that internal doors, i.e. those between the transfer chamber and the trunking to the diving bell and those separating living chambers within the chamber complex, are to be kept closed and sealed at all times except when divers are actually passing through them. Industry safety notices have been issued on this subject.

[41] Diving operations from vessels operating in DP mode, IMCA D 010 (Rev 1), International Marine Contractors Association.
[48] Recommendations on partial pressure of O_2 in bail out bottles, DMAC 04, Diving Medical Advisory Committee, IMCA.
[49] Marking and colour coding of gas cylinders, quads and banks for diving applications, AODC 016 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
[50] Length of diver's umbilicals from diving bells, AODC 020, Association of Offshore Diving Contractors (now IMCA).

6.1.21 Underwater Obstructions

Diving operations can be complicated by the number of lines deployed during operations: DP taut wire, equipment guide lines, clump weights and wires and diver and bell umbilicals, swim lines etc. This situation is however often simplified by the level of detailed planning involved in the operation, resulting in all involved parties having a clear understanding of responsibilities and expectations.

6.1.22 Diving from vessel underway

Diving from vessel underway is not permitted (except DP vessels in DP mode).

6.1.23 Live Boating

Live Boating is permitted from inflatable or small (less than 6.5 m) craft where propellers are properly guarded and man tended, and the umbilicals are distance marked

6.1.24 Diving at night from small craft

Diving at night from small craft shall not normally be permitted.

6.2 Environmental Considerations

The safe and efficient deployment and operation of divers is dependent upon suitable environmental conditions, and for any given situation the combination of these conditions can be dramatically different. It is the responsibility of the Diving Supervisor to assess all available information before deciding to conduct, to continue or to finish diving operations.

Each Diving Contractor normally defines clear environmental limits. Diving Supervisors must also ensure that they understand the implications of any other limitations which apply to vessels and deployment systems.

At no time should a Diving Supervisor allow contractual pressure to compromise the safety of personnel during ongoing or planned diving operations.

The following sub-sections are designed to highlight environmental aspects that effect diving operations. However, there is no substitute for practical experience.

6.2.1 Water Depth and Characteristics

Water characteristics may have a significant effect and the following factors must be taken into account when assessing the use of a diver on a given task:

- **Visibility**. Poor visibility can alter the effectiveness of the operation. Diving operations near or on the bottom can stir up fine grained sediment which may reduce visibility particularly in low or zero current situations.

- **Temperature**. Extreme temperature (both high and low) may affect the reliability of equipment and impose particular hazards on personnel.
- **Pollutants**. The presence of man-made and natural petroleum products around oil fields can cloud optical lenses and may damage plastic materials. Equally, gas can affect visibility, block sound transmission and cause sudden loss of buoyancy. Special precautions must be taken to protect the divers if pollutants are present, as well as protecting personnel who may handle the divers or their equipment during launch / recovery and during maintenance.
- Divers are very sensitive to water movement and great care must be taken in shallow water where surge of the water or the proximity of vessel thrusters can have a major effect on the ability of a diver to remain in a particular position [Ref. 35].

6.2.2 Currents

Currents can cause considerable problems in diving operations but unfortunately it is often the case that very little quantitative data on particular current profiles is available [Ref. 35].

Simulations and analysis can provide good indications of the effect of currents but often currents are not constant even close to the seabed. Currents vary with location and surface currents can be quickly affected by wind direction.

The use of a tide / current meter may provide information on the current strength and direction at any particular depth.

6.2.3 Sea State

The sea state can affect every stage of a diving operation. Rough seas require a heightened awareness of the possibility of accidents during recovery, both to the surface crew and to the divers. It is important, particularly in adverse sea states, that all personnel involved with launch and recovery wear all necessary personnel protective equipment and fully understand their own role as well as the role of others involved in the operation, such as the captain of the support vessel. Good communication is a vital factor in reducing the possibility of accidents.

Working from a support vessel in rough seas requires careful consideration of safety before and during launch and recovery. In certain situations, purpose-built deployment systems, e.g. motion compensation systems, can either reduce or better accommodate the effect of wave action thereby enabling diving operations to be conducted in higher than normal sea state conditions while maintaining normal safety standards.

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[35] The effects of underwater currents on diver's performance and safety, AODC 047, Association of Offshore Diving Contractors (now IMCA).

6.2.4 Weather

The cost and efficiency of operations can be adversely altered by the effects of weather.

While divers under water may not be directly affected by the various effects of weather, these can have an effect on diving operations in a number of different ways:

- Wind speed and direction can make station-keeping difficult for the support vessel.
- Rain and fog will cause a reduction in surface visibility, possibly creating a hazard for the support vessel [Ref. 34].
- Bad weather can make working on deck extremely hazardous for the diving crew, particularly with adverse combinations of wind, rain, etc.
- Hot weather can cause overheating. In particular umbilicals stored on deck are more susceptible to overheating by warm air or direct sunlight.
- Extreme heat (including direct sunlight) can cause the temperature inside deck chambers to rise to dangerous levels.
- Electric storms or lightning may be a hazard to exposed personnel or equipment.

Operations must therefore be carefully monitored with regard to the safety of both personnel and equipment.

6.2.5 Other Considerations

A Diving Supervisor must only allow a diving operation to begin after he has carefully considered all possible environmental criteria, their interaction with each other, and other factors including the deployment of equipment, the system's readiness, crew readiness and the nature and urgency of the tasks. This will normally form part of the Risk Assessment carried out for that operation.

6.3 Communications

Good communications are an essential ingredient of safe operations. The following principles must be observed.

6.3.1 Onboard Communications

A dedicated hard-wired intercom must link the Dive Control Position (Diving Supervisor) with the bridge, the DDC Control position and ROV control. It must include arrangements such as loudspeakers or head phones for passing instructions to people on deck, for communication between the Diving Supervisor and Winch Operator and for ensuring that the standby Diver and Tender can monitor communications with the Diver.

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[34] Diving when there is poor surface visibility, AODC 034, Association of Offshore Diving Contractors (now IMCA).

In the particular case of the crane operator (if there is one) he must always be able to communicate with the dive control position and the bridge by hard-wire if a static crane is installed. The operating position must be located to ensure ease of use, and communications equipment must be operable with one hand. A suitable back-up system, which need not be hard-wired, must also be provided.

Suitable communications must be provided between Dive Control and Operators of ancillary equipment.

When diving from a dynamically positioned (DP) vessel, the responsible person on the DP control panel must inform the Diving Supervisor of any possible change in position-keeping ability as soon as it is known. It is a requirement that sets of DP alarms are repeated in the diving control center.

6.3.2 Communications between vessel/barge and offshore installations

When diving on or in the close vicinity of an offshore installation or other unit, primary and back-up voice communications must always be established and manned between the Bridge of the vessel and an appropriate control position on the installation, throughout the period when divers are in the water.

Voice communications between other positions in the vessel, such as the dive control station position and the installation, must only be used if the installation is directly involved with the conduct of the dive, for example, by use of its crane. When such communications are used they must be monitored throughout on the vessel bridge. Diving Supervisors must inform the bridge of times of divers entering/leaving the sea.

The design of all communication arrangements must take into account the likelihood of high ambient noise levels.

6.4 Support Locations

Divers are required to operate from different locations with varying levels of support to the diving system and crew. Due consideration will be given, therefore, to the effect each location will have on the safety and efficiency of an operation. Such items as suitable deck strength, extra supports needed, external supplies available and the ease of launch and recovery must be considered.

Prior to mobilization it is recommended that a suitable person (this may be the Diving Supervisor) inspect the site and decide on the optimum location for the system. The level of services must also be assessed.

While it is not necessary for the various components of the diving system to be placed in a single location, care must be taken when considering hose or cable runs, which exceed standard system lengths. Hose and cable runs must be protected from physical damage and must not cause a hazard to personnel. Due account must be taken of voltage and/or pressure drops due to length.

There are six basic types of support location:

1. **Small Work boat, Supply Boat or Standby Vessel.**

   These are vessels of convenience from which diving may be carried out. They offer relatively low day rates compared to other support vessels but may also present operational limitations such as:

   - Lack of maneuverability.
   - Low grade navigation systems.
   - Very low or no capability for offshore mooring or position keeping system.
   - Minimal deck space.
   - Very low or no crane facilities.
   - Low electrical power reserves.
   - Unsuitable propeller guards.
   - Limited personnel accommodation.
   - Poor weather susceptibility for over side operations.
   - Lack of marine crew familiarity with diving operations.

   While such vessels can be used successfully in many situations, they must be carefully assessed prior to the project and a clear decision made that the limitations of the vessel are nevertheless acceptable in relation to the proposed work scope and envisaged environmental consideration.

2. **Small Air Range Diving Support Vessels and Larger Supply Boats**

   These vessels can be convenient for diving operations and will have some of the limitations listed in 1. above.

   Again such vessels can be used in a number of situations, but they still must be carefully assessed prior to the project to ensure that the limitations of the vessel are nevertheless acceptable in relation to the proposed work scope and envisaged environmental considerations.

   Often, the vessel's crew will be familiar with diving operations which can be very advantageous in difficult operating condition, or in an emergency.

   The range of vessels falling in to this category is substantial but some of the smaller or earlier generation vessels may still have some limitations which may well require careful consideration.

3. **Mono-hull Diving Support Vessels (DSV's)**

   Such vessels make good diving support ships but they are relatively expensive in comparison to other vessels due to the range of capabilities they can provide. ROV's may operate from DSV's in a complementary role to a diving operation in which case the requirements relating to the diver's safety take precedence at all times [Ref. 36].

[36] Remotely operated vehicle intervention during diving operations, AODC 032 (Rev 1), Association of Offshore Diving Contractors (now IMCA).

4. Fixed Platforms

While the fixed nature of an installation results in the absence of a number of the limitations imposed by floating structures, there are a number of specific problems associated with operating from a fixed platform such as:

- The need to comply with specific, often onerous, zoning requirements in relation to hydrocarbon safety.
- Space limitations leading to difficulty in installation of surface support equipment.
- Additional safety requirements imposed on personnel such as training in H_2S emergencies.
- The possibility of a power shut-down due to a preferential trip operation.
- Problems can arise if tidal effects on the diver make relocation difficult.
- Deployment and recovery may be complicated by the height between the platform and sea level.
- Additional hazards resulting from operations undertaken inside the jacket area.
- Intakes and Outfalls.

In addition, all platforms operate a 'Permit-to-Work' system which governs the operation of diving systems and may result in operational delays.

5. Temporarily Fixed Platforms

Included in this category are various large structures, which may in themselves be mobile but are intended to remain in one location during work. They may be maintained in that location by moorings, DP systems or other means. Examples would be drilling rigs, crane barges, accommodation barges etc.

These may present to diving operations similar hazards to those of a fixed platform, and while zoning and hydrocarbon safety requirements will normally apply to drilling rigs, other types of platform may have no such limitations.

These platforms may however have other hazards to diving operations such as anchor wires and submerged pontoons.

6. Specialist Locations

These can include multi-support vessels (MSVs), lay barges, trenching barges or specialized marine vessels.

Every specialist location will present different problems that will need to be carefully considered at the planning stage. On many specialized vessels one of the main limitations on diving operations is that the primary task, for example pipe-laying, cannot be interrupted without serious consequences.

It is important that all diving operations being conducted from a specialist location are planned to conform to a set of procedures agreed specifically for that location with the client.

6.4.1 Dynamic Positioning

Many of the above types of support location can be held in a fixed position by the use of dynamic positioning. This type of system can comprise anything from a supply boat captain using a joystick to manually maintain the vessel in one approximate location through to very sophisticated systems whereby several computers use external reference measurements to keep the vessel in an almost static position.

Dynamic positioning has its own inherent limitations and hazards in relation to diving operations:

- No system keeps the vessel static. All allow the vessel to move in a predetermined “footprint”, which can be quite large.
- Although many such systems are very reliable, all have the possibility of failure, which can leave a vessel effectively out of control close to a number of other vessels or fixed objects.
- DP uses the thrusters and propellers at all times which means that the diver and his umbilical can be at risk from these items or the wash that they generate.

For the above reasons, it is important that a thorough assessment is carried out prior to the offshore operation to establish what the capabilities and limitations are of the DP system on the proposed vessel. This can then be compared with the required scope of work and a decision made about suitability and any restrictions which may need to be put on the operation.

DP vessels may be classified in accordance with an International classification system which will assist in any such consideration.

Only vessels complying fully with all aspects (such as number of reference systems, levels of redundancy, crew competence etc.) of the International Standard for diving using DP must be used [Ref. 42, 43, 44].

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[42] Guidelines for the design and operation of dynamically positioned vessels, 103 DPVOA, Dynamic Position Vessel Owners Association, IMCA.
[43] Power system protection for DP vessels, 108 DPVOA, Dynamic Position Vessel Owners Association, IMCA.
[44] The training and experience of key DP personnel, IMCA M 117, International Marine Contractors Association.

6.5 Launch and Recovery

Because of the variety of diving systems, support locations and deployment systems, it is not possible to define every launch/recovery procedure in this document.

It is the responsibility of the Diving Supervisor to ensure that a safe launch/recovery procedure exists that is understood by all members of both the diving and the support installation crews. The procedure must progress in smooth, logical steps and be designed so that all personnel involved in the operation are fully aware of the situation at all times.

The Diving Contractor would be expected to have prepared appropriate calculations to a recognized standard, which may or may not have been checked by a certifying authority. These calculations may specify limits for launch and recovery based on weather/sea state/vessel motions or other parameters.

7. EMERGENCY AND CONTINGENCY PLANS

7.1 Diving Emergencies

The Diving Contractor's operations manual must contain a section laying out the actions required of each member of the diving team in the event of a foreseeable emergency occurring during operations.

The following list, which is not exhaustive, identifies the type of possible emergencies to be considered.

- Dealing with an injured or unconscious diver.
- Fire in a chamber or around the dive system.
- Loss of pressure in chambers or bell.
- Faulty or broken equipment.
- Approach of severe weather.
- Any eventuality from the vicinity of the diving operation and from external facilities / operations.

7.2 Lost Bell Contingency Plan

A contingency plan is required for the relocation and recovery of a lost closed bell. This must identify the actions of the Diving Contractor and other personnel, and the provision of specific equipment, such as locators [Ref. 11].

7.3 Hyperbaric Evacuation

In an emergency, divers in saturation cannot be evacuated by the same methods as other crew members. Special arrangements and procedures must be made to evacuate them safely while keeping them under pressure. For example, in a chamber capable of being removed from the worksite to a safe location while maintaining the divers at the correct pressure and with life support for a minimum of 24 hours.

The exact design of such equipment and its method of deployment will depend on the facilities available, the number of divers to be evacuated, the location of the worksite, etc. These factors must be considered during the risk assessment. The use of purpose-built hyperbaric lifeboats is one option, which should be considered.

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[11] Guidance Note on emergency diving bell recovery, AODC 019 (Rev 1), Association of Offshore Diving Contractors (now IMCA).

8. DOCUMENTATION

8.1 Equipment Certification and Maintenance

Guidance exists on the frequency and extent of inspection and testing required of all items of equipment used in a diving project, together with the levels of competence required of those carrying out the work [Ref. 18]. All of the equipment used in a diving operation will comply with at least these standards and suitable certificates (or copies) must be provided at the worksite for checking.

Diving equipment is used under extreme conditions including frequent immersion in salt water. It requires regular inspection, maintenance and testing to ensure it is fit for use, e.g. that it is not damaged or suffering from deterioration. Regular maintenance is an important factor in ensuring the safe operation of a diving system.

Diving Contractors must give due consideration to recommendations given in manufacturers' maintenance manuals.

Many complex action sequences are required during a diving project and there is a risk that steps may be omitted or performed out of sequence. A suitable way to ensure the thoroughness of such sequences on each occasion is the use of pre-prepared checklists that require the relevant personnel to tick a box to demonstrate correct completion.

Diving Contractors must prepare and authorize the use of such checklists as part of the planning for projects. A typical system check is described below in outline format.

8.1.1 Pre-and Post-dive Checks

Prior to diving commencing and after diving has been completed, a series of simple tests and examinations must be carried out to confirm that equipment is in good condition. These checks must include:

- A brief visual and 'touch' inspection prior to any power being turned on.
- Examination for cracks and dents, loose parts, unsecured wires or hoses, oil spots, discolouration, dirty camera lens etc.
- Each function must be briefly operated to ensure proper response.
- Loose bolts or couplings must be tightened or, if necessary, replaced.
- All mechanical parts must be kept clean and lubricated.
- Areas of potential corrosion must be examined and any necessary preventative or corrective measures undertaken.
- Major mechanical components must be regularly checked for alignment and abrasion.
- The handling system must be checked for structural damage.

[18] Codes of Practice in the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment - in accordance with UK Regulations, IMCA D018, International Marine Contractors Association.

- Electrical lines and connections must be examined and any hydraulic system inspected for leaks, abrasions and oil leaks. Fluid levels must be regularly checked.
- A function test must be performed on all brakes and latches.

8.2 Planned/Periodic Maintenance

The Diving Contractor must establish a system of planned maintenance for plant and equipment. Such a system may be based on passage of time, amount of use, manufacturer recommendations or previous operational experience, but ideally will be based on a combination of all of these.

The planned maintenance system must identify the frequency with which each task is to be undertaken and who should do the work. The individual involved must then complete a record of the work, either on paper or computer.

8.2.1 Spare Parts

Diving operations are often undertaken in remote offshore areas. Diving Contractors must ensure that an adequate serviceable supply of spare items is available, particularly for those items, which are essential to continued operation and safety.

8.3 Equipment Register

An equipment register must be maintained at the worksite with copies of all relevant certificates of examination and test. It must contain any relevant additional information such as details of any applicable design limitations, for example, maximum weather conditions for use.

8.4 Operating Procedures

The operating procedures will consist of a Diving Contractor's standard operating rules and any site-specific risk assessments and procedures. The procedures must cover the general principles of the diving techniques as well as the needs of the particular operation. They must also provide contingency procedures for any foreseeable emergency.

The management of a project must be clearly specified together with a defined chain of command.

Many factors must be considered when preparing the procedures for a specific project. A risk assessment must identify site-specific hazards and their risks. Based on this information, the procedures must then need to state how these hazards and risks can be controlled. An exhaustive list of hazards and risks is not possible but some are highlighted in the previous sections.

Documentation must include:

- A clearly defined scope of work and a list of resources, personnel and any tooling necessary to execute the programme.
- Risk Assessment.
- A mobilization plan.
- A Quality Assurance (QA) Summary.
- A logistics plan.

In certain circumstances (such as a contractual or legislative requirement) specific documentation and procedures covering the intended scope of work should be prepared and submitted to the client for approval.

8.5 Manuals and Documentation

A major factor in a safe and efficient diving operation is the supply of a comprehensive set of manuals, checklists and logbooks appropriate to the operation. It is the responsibility of every contractor to ensure that each diving system is supplied with the necessary documentation including at least the following:

- Contractor's operations manual.
- Safety management system.
- System equipment technical manuals.
- Daily diary/report book.
- Planned maintenance system.
- Repair and maintenance record.
- Systems spares inventory.
- Pre/post dive check list.

8.5.1 Reference Documentation

Diving Contractors must be familiar with all relevant legislation for the areas in which they are operating and the various advisory publications relevant to diving operations. Some examples of these are listed in the references at the end of this document.

8.6 Diving Operations Log

Diving Contractors must ensure that a written record is kept on a daily basis of all the activities carried out and of any other relevant factors.

There is no specific format that this document should take. However, the following matters are a minimum level of information to be recorded:

- Name and address of the Diving Contractor.
- Date to which entry relates (an entry must be completed daily by each supervisor for each diving operation).
- Location of the diving operation, including the name of any vessel or installation from which diving is taking place.
- Name of the supervisor making the entry and date on which the entry was made.
- Names of all those taking part in the diving operation as divers or other members of the dive team.
- Any Codes of Practice which apply to the diving operation.
- Purpose of the diving operation.
- Breathing apparatus and breathing mixture used by each diver in the diving operation.
- Decompression schedule containing details of the pressures (or depths) and the duration of time spent by divers at those pressures (or depths) during decompression.
- Emergency support arrangements.
- Maximum depth which each diver reached.
- Time at which each diver leaves atmospheric pressure and returns to atmospheric pressure plus his bottom time.
- Any emergency or incident of special note which occurred during the diving operation, including details of any decompression illness and the treatment given.
- Any defect recorded in the functioning of any plant used in the diving operation.
- Particulars of any relevant environmental factors during the operation.
- Any other factors likely to affect the safety or health of any persons engaged in the operation.

8.7 Divers' Personal Log Books

Divers must keep a detailed daily record of any dives they have carried out. There are a number of hard bound logbooks available for this purpose, e.g. the IMCA publication. However, any suitable log book can be used. The following is the minimum information which needs to be entered in the diver's logbook.

- The name and address of the Diving Contractor.
- The date to which the entry relates (an entry must be completed daily for each dive carried out by the diver).

- The name or other designation and the location of the installation, worksite, craft or other place from which the diving operation was carried out.
- The name of the Diving Supervisor who was in control of a diving operation in which the diver took part.
- The maximum depth reached on each occasion.
- The time the diver left the surface, the bottom time, and the time the diver reached the surface on each occasion.
- Where the dive includes time spent in a compression chamber, details of any time spent outside the chamber at a different pressure.
- The type of breathing apparatus and mixture used by the diver.
- Any work done by the diver on each occasion, and the equipment (including any tools) used in that work.
- Any decompression schedules followed by the diver on each occasion.
- Any decompression illness, discomfort or injury suffered by the diver.
- Any other factor relevant to the diver's safety or health.
- Any emergency or incident of special note which occurred during the dive.

The entry must be dated and signed by the diver and countersigned by the Diving Supervisor.

8.8 Use of Checklists

Many complex action sequences are required during a diving project, for example, checking a diving bell before deployment. There is a risk that steps may be omitted or performed out of sequence. A suitable way to ensure the thoroughness of such sequences on each occasion is the use of pre-prepared checklists that require the relevant personnel to tick a box to demonstrate correct completion. Diving Contractors must prepare and authorize the use of such checklists as part of the planning for diving projects.

9. SCIENTIFIC, ARCHAEOLOGICAL, ENVIRONMENTAL & MEDIA DIVING

(CARRIED OUT ON BEHALF OF ADNOC GROUP COMPANIES)

This type of operation by any ADNOC Division or Group Company will require a dive plan to be submitted to the Group Company Competent Person for diving.

9.1 General

When planning and implementing such programmes, Job Officers must be aware that these operations are subject to different standards than normal commercial/oil field diving operations. Internationally accepted codes have been established keeping in mind that such operations are not normally as hazardous as commercial/oil field diving operations and that the divers are normally scientific professionals rather than professional commercial divers. Different skill and operational standards are therefore considered applicable.

Diving procedures in such codes allow the use of Scuba with certain controls. Additionally the other limitations on the use of Scuba, small boats, environmental conditions and decompression facilities may also apply. Before the operation commences the contractor must apply for approval from the Group Company department to use Scuba, quoting the particular code or standard to be utilized and submit a risk assessment. Diving rules (Diving Manual), Emergency Procedures and work procedures must also be submitted to the relevant department for review and approval.

9.2 Scuba Restrictions

If a Scuba dispensation is applied for/granted, the following restrictions must also be applied.

Scuba diving is not permitted:

- In condition Beaufort 3 and above.
- In currents exceeding 1 knot.
- In water visibility less than 2 meters.
- For dives requiring operational decompression.
- Without using an ABLJ.
- During hours of darkness.
- With a total team size less than 5 including boat crew, Diving Supervisor, diver, standby diver and tender.
- Without the use of a lifeline to surface unless the diver is connected by a buddy line, not exceeding 2 meters, to a second diver who is equipped with a line and surface buoy.

9.3 Communications

The dive boat must have the ability to communicate with shore or main diving vessel (if diving from a small craft) in case of an emergency. The Diving Supervisor must also locate the nearest chamber and have an agreement that in an emergency recompression, facilities will be available.

9.4 Operational Standards

The following codes are accepted by ADNOC in regards to the scope of works to which they apply:

- The American Academy of Underwater Sciences Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.
- UK HSE Diving at Work Regulations Scientific and Archaeological Diving Code.
- UNESCO/CMAS Scientific Diving Codes of Practice.
- Any other similar Codes of Practice which can be shown to be of an equal or higher standard to the previously named codes (to be approved by the Group Company Competent Person / Relevant Department).

9.5 Personnel Requirements

All diving related personnel will be subject to interview and must demonstrate that they posses the required experience and qualifications for the particular task(s) to be performed. Diving logbooks and original qualifications certificates, medical examination certificates and appropriate first aid training certificates must be produced. Diving Supervisors particularly must demonstrate an excellent understanding of safety requirements including accident procedures and Emergency and Contingency Plans.

The following diving qualifications are acceptable for this scope of diving operations:

a) CMAS 3 star diver or equivalent.
b) PADI Rescue Diver.
c) NAUI Master Diver.

} Plus any additional requirements of the particular Codes of Practice for scientific diving

Plus any additional requirements of the particular Codes of Practice for scientific diving

- Any other qualifications required and accepted by the above codes for scientific diving programmes.
- Any of the higher qualifications specified in this document for commercial divers.
- Diving Supervisors must be experienced in the type of equipment to be used and type of diving operation to be supervised. First Aid training for Diving Supervisors is mandatory and such training must include instruction

in the use of emergency oxygen administration. Diving Supervisors must be appointed in writing by the employer of divers.

Any person who will be required to conduct work underwater must be in possession of a valid medical certificate.

REFERENCES

The following is a list of documents give more detailed information on subjects covered in the COP. In some cases, these documents may be based on the Regulations of a particular country. Their content should be considered as sound advice rather than a fixed requirement.

1. The Merchant Shipping (Diving Safety) Regulations 2002, S.I. No. 1587, HMSO, London, 2002.
2. Protection of Water Intake Points for Diver Safety, AODC 055, Association of Offshore Diving Contractors (now IMCA).
3. Communications with Divers, AODC 031, Association of Offshore Diving Contractors (now IMCA).
4. Gas cylinders used in conjunction with diving operations in areas governed by UK Regulations, AODC 010 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
5. Periodic Examination of bail-out bottles, AODC 037, Association of Offshore Diving Contractors (now IMCA).
6. Ingress of Water into Underwater Cylinders charged by means of a Manifold System, AODC 064, Association of Offshore Diving Contractors (now IMCA).
7. Diver's Gas Supply, AODC 028, Association of Offshore Diving Contractors (now IMCA).
8. Emergency air bottles in diving baskets, AODC 039, Association of Offshore Diving Contractors (now IMCA).
9. Oxygen Cleaning, AODC 029, Association of Offshore Diving Contractors (now IMCA).
10. Emergency isolation of gas circuits in the event of a ruptured bell umbilical, AODC 009, Association of Offshore Diving Contractors (now IMCA).
11. Guidance Note on emergency diving bell recovery, AODC 019 (Rev 1), Association of Offshore Diving Contractors (now IMCA).
12. Bell emergency location equipment trials, AODC 012, Association of Offshore Diving Contractors (now IMCA).
13. Diver emergency heating, AODC 026, Association of Offshore Diving Contractors (now IMCA).
14. Bell Ballast Release Systems and Buoyant Ascent in Offshore Diving Operations, AODC 061, Association of Offshore Diving Contractors (now IMCA).
15. Guidance Note on the marking of hyperbaric rescue systems designed to float in water, AODC 017, Association of Offshore Diving Contractors (now IMCA).
16. Codes of Practice for the safe Use of Electricity Under Water, AODC 035, Association of Offshore Diving Contractors (now IMCA).

17. Prevention of Explosions during Battery Charging in relation to Diving Systems, AODC 054, Association of Offshore Diving Contractors (now IMCA).

18. Codes of Practice in the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment - in accordance with UK Regulations, IMCA D018, International Marine Contractors Association.

19. Proximity to a recompression chamber after surfacing, DMAC 22, Diving Medical Advisory Committee, IMCA.

20. Underwater Air Lift Bags, IMCA D016 (Rev. 1), International Marine Contractors Association.

21. Offshore diving supervisor and life support technician schemes, AODC 053 (Rev 1), Association of Offshore Diving Contractors (now IMCA).

22. Medical equipment to be held at the site of an offshore diving operation, DMAC 15 (Rev 1), Diving Medical Advisory Committee, IMCA.

23. The provision of emergency medical care for divers in saturation, DMAC 28, Diving Medical Advisory Committee, IMCA.

24. The training and refresher training of doctors involved in the examination and treatment of professional divers, DMAC 17, Diving Medical Advisory Committee, IMCA.

25. First aid training for divers and diving supervisors, DMAC 11, Diving Medical Advisory Committee, IMCA.

26. Guidance on assessing fitness to return to diving after decompression illness, DMAC 13 (Rev 1), Diving Medical Advisory Committee, IMCA.

27. Aide memoire for recording and transmission of medical data to shore, DMAC 01, Diving Medical Advisory Committee, IMCA.

28. In water diver monitoring, DMAC 02, Diving Medical Advisory Committee, IMCA.

29. The effect of sonar transmissions on commercial diving activities, DMAC 06, Diving Medical Advisory Committee, IMCA.

30. Safe diving distance from seismic surveying operations, DMAC 12, Diving Medical Advisory Committee, IMCA.

31. Recommendations for flying after diving, DMAC 07, Diving Medical Advisory Committee, IMCA.

32. Guidance on the duration of saturation exposures and surface intervals between saturations, DMAC 21 (Rev 1), Diving Medical Advisory Committee, IMCA.

33. SCUBA, AODC 065, Association of Offshore Diving Contractors (now IMCA).

34. Diving when there is poor surface visibility, AODC 034, Association of Offshore Diving Contractors (now IMCA).

35. The effects of underwater currents on diver's performance and safety, AODC 047, Association of Offshore Diving Contractors (now IMCA).

36. Remotely operated vehicle intervention during diving operations, AODC 032 (Rev 1), Association of Offshore Diving Contractors (now IMCA).

37. Guidance note on the safe and efficient operation of remotely operated vehicles, AODC 051, Association of Offshore Diving Contractors (now IMCA).

38. Codes of Practice for the use of high pressure water jetting equipment by divers, AODC 049, Association of Offshore Diving Contractors (now IMCA).

39. Accidents with high pressure water jets, DMAC 03, Diving Medical Advisory Committee, IMCA.

40. Oxy-arc cutting operations under water, IMCA D 003, International Marine Contractors Association.

41. Diving operations from vessels operating in DP mode, IMCA D 010 (Rev 1), International Marine Contractors Association.

42. Guidelines for the design and operation of dynamically positioned vessels, 103 DPVOA, Dynamic Position Vessel Owners Association, IMCA.

43. Power system protection for DP vessels, 108 DPVOA, Dynamic Position Vessel Owners Association, IMCA.

44. The training and experience of key DP personnel, IMCA M 117, International Marine Contractors Association.

45. Minimum quantities of gas required offshore, AODC 014, Association of Offshore Diving Contractors (now IMCA).

46. Recommendations on minimum level of O_2 in helium supplied offshore, DMAC 05, Diving Medical Advisory Committee, IMCA.

47. Guidance note on the use of inert gases, AODC 038, Association of Offshore Diving Contractors (now IMCA).

48. Recommendations on partial pressure of O_2 in bail out bottles, DMAC 04, Diving Medical Advisory Committee, IMCA.

49. Marking and colour coding of gas cylinders, quads and banks for diving applications, AODC 016 (Rev 1), Association of Offshore Diving Contractors (now IMCA).

50. Length of diver's umbilicals from diving bells, AODC 020, Association of Offshore Diving Contractors (now IMCA).

51. ADNOC Manual of Codes of Practice: '*Guideline on HSE Definitions & Abbreviations',* ADNOC-COPV1-05.

52. ADNOC Manual of Codes of Practice: '*Directions for preparing the Annual HSE Letter*', ADNOC-COPV1-07.

53. ADNOC Manual of Codes of Practice: '*Guideline on Occupational Health Risk Assessment (OHRA)*', ADNOC-COPV3-08.

APPENDIX A
CHECKLIST FOR INITIAL SAFETY ASSESSMENT OF DIVING CONTRACTORS

INITIAL SAFETY ASSESSMENT OF DIVING CONTRACTORS

1. Purpose

The purpose of this exercise is to ensure that the initial safety assessment of a Contractor is conducted in a consistent and auditable manner. It will also enable the safety assessor (who will normally be the Group Company Competent Person for Diving Operations) to expeditiously advise his senior of his assessment and whether the Contractor meets the basic requirements, from a safety point of view to be included on an approved bid list.

It should be stressed that this initial exercise will only provide information for the first stage of the audit. Before new Contractors can be fully and finally approved it is envisaged that site visits, plant inspections and other checks and audits would need to be conducted.

2. General Notes

- The majority of the questions are intended to seek whether the Contractor provides for the diving operation to be conducted as part of the overall Safety Management System and not in isolation to it.
- To give a “NO” answer to questions does not necessarily imply that the provisions are unacceptable since, in some cases, it may be that the question is inappropriate in the particular circumstances.
- It should be recognized that many of the answers to the questions may be found in Contractors manuals, documents, procedures, etc.. other than in specific diving manuals.
- It is emphasized that Contractor is required to demonstrate the adequacy of his system and not to demonstrate in detail how compliance with specific requirements is to be ensured.
- The assessment must be signed by the persons conducting the audit and must state the contractor is acceptable, conditionally acceptable, or not acceptable.
- Any conditions may be included in the “Main recommendations” section or on separate supporting report. Such reports must be attached and cross referenced in the main recommendation section.
- The assessment must be endorsed by the Head of Safety (or his designate in his absence).
- The job officer must be officially notified of the audit findings and in turn inform the contractor.

CHECKLIST FOR THE INITIAL SAFETY ASSESSMENT OF DIVING CONTRACTORS

NAME OF CONTRACTOR: .....

AUDIT DATE: .....

SECTION A - POLICY AND ORGANISATION

ITEM	SUBJECT	REMARKS
1.	Is Contractor a member of IMCA or any equivalent organization (local or international)?	
2.	Does the organization have an H.S.&E. policy statement that commits both senior and operational personnel to Health, Safety & Environmental issues and does it specifically mention diving related activities?	
3.	Is the policy statement consistent throughout the Contractors documentation and signed by the U.A.E. based chief or senior executive. Is the same policy statement displayed at offices, sites and workshops?	
4.	Is there a clear and definitive chain of command chart showing the various responsibilities/duties/reporting path between various positions?	
5.	Does Senior Management demonstrate their commitment to HSE issues by making frequent offshore visits and can such visits be effectively verified?	
6.	Has the Contractor designated one individual to be responsible for diving safety? If so, what is his official title?	
7.	Does he have a formal Job Description stating his duties, responsibilities in regard to safety?	
8.	Is he adequately qualified and experienced to fulfil his role? State how/details/ qualifications.	
9.	Does the Contractor have adequate HSE documentation including: • HSE Management Manual. • Diving Safety Manual. Marine Operations Manual (if diving Co. also owns vessels).	
10.	Who is responsible for updating the above documentation and what are the dates of the current editions?	
11.	Are they controlled and is there a nominated document controller, what is the controller's official position?	

ITEM	SUBJECT	REMARKS
12.	Does the diving operations/safety manual contain adequate instruction to ensure the health and safety, emergency response and contingency plans for diving operations specific to installations, site hazards and their environments?	
13.	Does the Contractor carry current adequate third party liability/employee insurance?	
14.	Does the Contractor distribute the Diving Safety documentation to sites and appropriate client and sub-contractor positions.?	
15.	Does the Contractor's HSE documentation state specific: • Governing standards. • Personnel training and qualification requirements. • Plant requirements + inspection/test/certificate requirements.	
16.	Does the Contractor have: • An adequately equipped Emergency Response Room to handle Marine/Diving emergencies. • A nominated liaison man to coordinate with clients and clients Emergency Response Room. • A consultancy agreement with a local qualified diving physician for emergency hyperbaric situations. Name the Doctor and his base.	
17.	Are onshore safety meetings held with Management, sub-contractors and clients minuted/verifiable?	
18.	Are minutes distributed to relevant offshore personnel, clients and sub-contractors?	
19.	Does the Contractor's HSE Management System provide for external audit of its HSE Management System?	
20.	Does the Contractor's HSE Management System provide a procedure for auditing its own and sub-contractors Health & Safety Management Systems / Policies?	
21.	Is the Contractor's Management formally advised of the findings of such audits and is there evidence that such audits are being conducted?	

SECTION B - PLANNING & IMPLEMENTATION

ITEM	SUBJECT	REMARKS
1.	Is the Management structure sufficient in numbers and competence to support the proposed operation and is there adequate staff support including arrangements to cover leave periods?	
2.	Are work scopes/procedures critically analysed in regards to the Health & Safety of the personnel involved in the operations?	
3.	Who is responsible for analysing work scopes and procedures for HSE Matters?	
4.	Does the Contractor make provision for documents to bridge his own emergency procedures and those of clients and sub-contractors?	
5.	Who is responsible for producing, updating and distributing the bridging documents?	
6.	Who is responsible for compilation of the Project Safety Plan?	
7.	In the case of a rapid mobilization requirement does the Contractor have in place a procedure to ensure safety inspection and formal safety requirements are being followed?	
8.	Does the Contractor hold pre-mobilization meetings with the client and sub-contractors to discuss H,S&E matters, safety policy on site hazards, restrictions, emergency and contingency plans, work permit requirement, accidents and incident reporting?	
9.	Are such meetings recorded/minuted and is there a formal procedure to ensure relevant onshore and offshore personnel are provided with instructions arising from such meetings?	
10.	Do Contractor's personnel, both offshore and onshore, who are involved in the planning and implementing of diving operations, have formal job descriptions stating their duties, responsibilities and qualification requirements?	
11.	Do the Contractors personnel qualification + experience standards comply with ADNOC requirements?	
12.	Is there any evidence that Contractors are vetting personnel to ensure they meet the required standards and possess the experience claimed in c.v.'s? Are references required and checked?	
13.	Is there any record of contractors personnel attending site / vessel safety inductions prior to commencing operations?	
14.	Is there any evidence that effective initial and ongoing competence assessments are being conducted on personnel?	

ITEM	SUBJECT	REMARKS
15.	Are Masters of Marine Vessels and other appropriate associated personnel being vetted for their experience of working on diving operations and knowledge of basic diving safety or is the Contractor conducting basic diving safety induction?	
16.	Does the Contractor's Safety Management System establish preventive controls for all identified potential health and safety hazards at (and adjacent to) the dive site, and on his own premises?	
17.	Is there any evidence of an adequate Planned Maintenance Schedule being implemented and does this include prevention of breakdown by prudent replacement of components?	
18.	Does the Contractor carry substantial/adequate spare parts in his stores/ on site?	
19.	Does the Contractor have adequate premises, workshop and skilled technicians for maintaining and repairing diving equipment/dive support vessels (if also vessel owners)?	
20.	Contractors office / workshop – Adequate communications equipment present, first aiders, first aid boxes, fire extinguishers, fire escapes, alternative escape route present escape procedures posted. Fire drills regularly conducted / logged.	
21.	Does the Contractor's procedure provide for a proven / adequate method of evacuation of divers from vessels or installations taking into account divers may be under pressure?	
22.	Does the Contractor's procedure take into account the need for adequate and protected escape routes from dive control and the placing of diving plant and stations in safe areas?	
23.	Are there procedures provided by the Contractor to ensure diver emergency and specific diving safety drills and evacuation drills are conducted at regular intervals?	
24.	Does the Contractor have a policy or a formal procedure requiring them to inform other diving operators in the area of their working location in order to give / receive assistance on diving related matters in case of an emergency?	
25.	Has the Contractor developed and uses predive checklists and are they adequate?	
26.	Are Diving Supervisors IMCA certified (or equivalent) and do their log books verify the required familiarization of the Contractors diving rules, emergency and contingency plans has been conducted?	
27	Is the Risk Assessment carried out and findings incorporated in the procedure/work instructions?	

SECTION C - MEASURING PERFORMANCE

ITEM	SUBJECT	REMARKS
1.	Does the Contractor, in addition to "in-house" HSE documentation, have an adequate technical reference library to enable him to implement and measure safe working operations e.g. as minimum: • IMCA / AODC Guidelines. • IMCA monthly publications. • HSE DSM's. • UK Diving Regulations. • Certifying Authority Rules. • DMAC notices. • Guidance to regulations / risk assessment / Successful Health & Safety Management Systems.	
2.	Are appropriate AODC/IMCA guidelines, DSMs and DMAC notices provided to diving sites in addition to in-house HSE documentation?	
3.	Are unbiased "on site" safety inspections conducted to determine the percentage of compliance with statutory, ADNOC and Contractor's regulations?	
4.	Does the Contractor conduct on "on site" safety assessment surveys which encourage personnel involvement in conducting the surveys?	
5.	Are audit, safety reports and inspection results distributed to management and offshore personnel, client's representatives and sub-contractors when appropriate?	
6.	Does the Contractor require regular on site safety meetings to be conducted? If so, how often?	
7.	Are the minutes of such meetings copied to the onshore management, person in-charge of site, client's representative and displayed on site notice board?	
8.	Are Contractors management reviewing these minutes and responding back to offshore sites to keep them informed of reaction to items and progress regarding safety suggestions? Has the onshore safety officer a duty to ensure action and reply?	
9.	Are diving related, or any other accidents and incidents, reported in an acceptable format and records kept?	
10.	Are accidents / incidents investigated thoroughly, competently and do such investigations include specialists and senior management when appropriate?	

ITEM	SUBJECT	REMARKS
11.	Are investigation reports and recommendations distributed to management, sites and clients as appropriate?	
12.	Does the Contractor have established procedures for dealing with: • Any personnel who blatantly contravene safety practices and regulations. • Reward of his own personnel who achieve exemplary safety standards or innovations / suggestions.	

SECTION D - REVIEWING PERFORMANCE

ITEM	SUBJECT	REMARKS
1.	Is there a requirement for controlled documentation (including that in clients possession) to be returned to the document controller?	
2.	Are post contract meetings held?	
3.	Are formal personnel performance assessments conducted and are assessment forms completed by the employee's immediate supervisor?	
4.	Does the Contractor possess adequate historical accident / incident data for risk assessment purposes?	
5.	Are accidents and incidents analyzed to not only identify immediate causes but also underlying causes?	
6.	Are annual accidents statistics produced which identify accidents / incidents by type + frequency and identify any trends in order to formulate future responses / possible changes to the Contractors S.M.S.?	
7.	Are these statistics circulated to Management, sites and clients?	
8.	Is there a Safety Improvement Plan in operation and a procedure for ensuring that HSE matters and recommendations from previous contracts and accident investigations are considered, implemented and included as appropriate in HSE manuals.	
9.	How often is the Contractor's **SMS** audited / assessed for improvement by **external** auditors? When was the last **external** audit?	
10.	Is there any evidence to indicate steps have been taken to implement external audit recommendations and to what percentage have they been implemented?	
11.	How often are internal SMS conducted / date of last internal audit?	
12.	Is there any evidence to indicate implementation of internal audit recommendations and to what percentage level have they been implemented?	

CHECKLIST FOR THE INITIAL SAFETY ASSESSMENT OF DIVING CONTRACTORS

MAIN RECOMMENDATIONS

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AUDITOR: ..... SIGNED: .....

NAME: ..... POSITION: .....

ENDORSED: ..... SIGNED: .....

NAME: ..... POSITION: .....